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THE NET EARNINGS OF 124 RAILWAYS for the month of May and the first five months of 1890, according to the statistics collected by the *Financial Chronicle*, are as follows, compared with the same periods of the previous year:

	May.	Jan. 1 to May 31.
1889	$47,478,854	$234,408,000
1890	54,139,680	261,053,329

This is an increase of 15.81%. Considering the roads geographically, the Southern roads show the large increase of 35.42% per cent. in net earnings and the Southwestern lines exhibit a yet larger increase, 47.75%. In the last group, however, the Atchison system plays an important part in the result, its net increase being $453,006. Of the other groups the Pacific roads show a gain of 18.22%, and the Middle Western, the coal roads, the Northwestern, and the Eastern and middle groups show increases of 13.57%, 11.31%, 6.46% and 5.39% respectively.

THE ZONE PASSENGER TARIFF SYSTEM will be tried on one of the Swedish railways. There will be eight zones, each 7.45 miles wide; the third class fare will be nearly 8 mills, second class 1.6 cts., first class 2.4 cts. per mile. Free baggage to the amount of 55 lbs. may be carried.

NEW RAILWAY LINES IN AUSTRALIA, with an extent of over 1,100 miles, are proposed, and a bill has been introduced in Parliament by the Premier providing for a Government grant of £2,000,000 for their construction.

A CONSIDERABLE LOT OF STEEL TIES, of the Standard Metal Tie & Construction Co.'s pattern, are to be laid on the Delaware & Hudson Canal Co.'s R. R. A gang of 50 men are to be put to work laying them on July 26, near Ballston, N. Y.

THE WEST SHORE COLLISION at Genesee Junction, referred to in our list of last week as a grade crossing collision, did not occur on the crossing at all, so Mr. C. W. BRADLEY, General Superintendent of the West Shore, informs us. Mr. BRADLEY sends the following account of the circumstances of the collision:

An accident occurred at Genesee Junction at 1:47 A. M. on the morning of July 15, between a West Shore and a Western New York and Pennsylvania train. The grade crossing of these roads at Genesee Junction is protected by gates. A West Shore freight train with 37 cars, going west, made the usual crossing stop, and after the gates were opened, proceeded, and at a point 900 ft. west of the crossing struck a Western New York and Pennsylvania engine standing on the frog of the northwest "Y" connecting the West Shore and the Western New York and Pennsylvania roads. The Western New York and Pennsylvania engine was not protected in any way. The West Shore train was on its own track, and had the right to be where it was when it came in contact with the Western New York and Pennsylvania engine.

THE WORST ACCIDENT OF THE WEEK occurred on July 23 at Pigerton, Wis., on the Milwaukee, Lake Shore & Western Ry. Two heavy freight trains came together on a curve, killing both firemen, two brakemen and seriously injuring both engineers. Other collisions of the week have been as follows: At Antigo, Wis., July 22, two freight trains collided, killing two men and seriously injuring two. On July 17, on the Indianapolis, Decatur & Western Ry., a rear end collision killed two men and seriously injured one. The forward train had backed up to take a run at a steep grade. On July 16 a collision between two freight trains, 1½ miles east of Wellsville Kan., killed the engineer of one train. On July 20, at Greencastle, Ind., a head collision occurred between two freight trains on the Louisville, New Albany & Chicago, seriously injuring one man. One train was a double-header. On July 21 at Pueblo, Col., an Atchison, Topeka & Santa Fe passenger train ran into a Fort Worth & Denver City freight train at a grade crossing. It is claimed that the air brakes failed to work. At Fort Atkinson, Wis., July 15, on the Chicago & Northwestern, a stock train ran into the rear of a way freight three hours behind schedule time, injuring one man. On July 17, near Freeland, Md., on the Northern Central, an extra freight ran into the rear of a wrecking train, injuring three men. On July 18, at Hooperstown, Ill., on the Chicago & Eastern Illinois, a special train of 15 empty coaches was run into by a freight train. On July 19, near Cook's Falls, N. Y., a special train of new passenger coaches for the recently finished Ontario, Carbondale & Scranton, was run into by a following fast freight. One man was killed and two were injured. On July 17 a freight train on the Cincinnati, Wabash & Michigan became stalled on a bridge across the Wabash River, and was run into by a passenger train in the rear. The collision was a slight one and little damage was done.

THE WORST BRIDGE ACCIDENT for some time occurred near Limon, Col., on the Chicago, Rock Island & Pacific, July 21. The bridge was a small span, 30 ft. long and 15 ft. high, and was washed out by a sudden storm. The engine and 3 cars went into the gap, killing the engineer and injuring 13 others. ——A highway bridge near Lynn, Ind., fell under a traction engine on July 18.

SEVERE STORMS have occurred near Denver, Col., washing out the Denver, South Park & Pacific Railway. One section of track has been washed out three times in two weeks. Several other Colorado roads have suffered from washouts. Other washouts have occurred on the Missouri Pacific, near Lexington, Mo., and on the Baltimore & Ohio's Wheeling division. More cyclones have occurred in Minnesota and Dakota; one at Peoria, Ill., wrecked a freight train.

A PASSENGER ELEVATOR TO THE SUMMIT OF MONT BLANC is a scheme proposed by an American mining engineer. It is proposed to construct a shaft from a convenient level to the summit, composed of eight compartments, each 6 ft. square, and each to carry a triple-decked elevator with a capacity for 27 passengers.

THE CHIGNECTO SHIP RAILWAY has 1,200 men now at work on it, and stone is now being laid at the Amherst dock. It is expected to lay the track this fall. No obstacles of any moment have as yet arisen in regard to any part of the work or plant.

THE CANADIAN PACIFIC'S STEAMSHIPS now under construction by the Naval Construction and Armament Co., of Barrow-in-Furness, are to be finished in a few months, the first one being launched probably next month, and will be ready for service by the end of October. The other two are to follow at intervals of about two months. The contract requirements for speed are 18 knots on the measured mile, and 16½ knots on a 400 miles' sea trial. The vessels will be 485 ft. between perpendiculars; breadth moulded, 51 ft.; depth, moulded, 36 ft.; the total displacement will be 5,700 gross tons.

The engines are expected to develop about 10,000 I. H. P., and twin screws and fore-and-aft bulkheads according to the best modern practice will be provided. The propeller shaft will be carried within the structure of the hull to the very extremity, thus doing away with the outboard shaft bearing, which is supposed by some to have caused the *City of Paris* disaster. The vessels will be lit by electricity and ventilated by fans of 400,000 cu. ft. per hour capacity, driven by electric motors.

It is said that when these vessels are completed the Canadian Pacific intends to make a feature of "round-the-world" excursions.

ERICSSON'S *Destroyer*, upon the perfection of which the great inventor spent the larger part of his time during the last years of his life, seems in a fair way to be placed upon the list of coast defense vessels. The vessel is of iron, 130 ft. long, 17 ft. beam and 11 ft. deep, and is very massively built, being designed to fight at short range. It is armored with a submarine gun fitted into the bow and firing a projectile containing a heavy explosive charge. The range of the gun is from 500 ft. to 1,000 ft. The necessary appropriation for the gun has been made by Congress and a test will be made as soon as it can be constructed.

THE CORROSION OF THE PLATES OF THE CRUISER *Yorktown* seems to have been considerable. The defects are most prominent on the plates just below gangways and on the forward part of the vessel. Large areas are corroded and pitted to a depth of $\frac{1}{16}$ in. The anti-fouling paint used on the bottoms of all the new cruisers does not appear to be an effective preventive of corrosion.

THE CORROSION OF STEEL BY SALT WATER is said to be much greater than that of iron. MR. DAVID PHILLIPS stated in a recent address before the British Institute of Marine Engineers that he had experimented from 1881 to 1888 with two plates of Bessemer boiler steel, two of Yorkshire and two of B. B. Staffordshire boiler iron. The plates were, as nearly as possible, 6×6×⅝ ins., and were kept immersed in salt water. The results show a great difference between the behavior of steel and iron; the steels lost 120% more than the irons the first three years, when the plates were in contact; 124% more the second three years, when they were insulated; and 126% more for the whole period of seven years.

A LARGE CAST STEEL GUN, 50 ft. long with an inside diameter of 15 ins. and weighing about 40 tons, has been cast by the West Point Foundry for the Pneumatic Gun Co. It has been successfully tested, and will be shipped soon to Australia.

THE NEW RIFLE with which the German army has just been equipped has shown remarkable penetrating power. The gun is a 30-cal. repeater, with a range of 3,000 yds. The projectile is a steel-cased nickel-plated leaden bullet with a very sharp point. According to the tables of penetration in the musketry instructions accompanying the rifle, it penetrates dry deal 32 in. at a distance of 110 yds.; at 440 yds., similar wood, 18 in. thick; at 800 yds., 10 in.; at 2,000 yds., 2 in., and at 330 yds., iron plates 7-25 of an inch thick. The depth the shot penetrates into newly thrown up sand amounts, at 110 yds., to about 36 in.; at 440 yds., 20 in.; at 880 yds., 14 in., and at 2,000 yds. to 4 ins. These new and most deadly weapons have brought about an entire revolution in infantry tactics in Germany, and other nations are following her lead.

A REMARKABLE TUNNEL RECORD was made during the month of June by Mr. MCCORMICK, the contractor who is driving the Mississippi River tunnel. His record of 298 ft. of clear tunnel was made, notwithstanding the loss of 4 shifts, in 30 days and the usual loss on Sundays, making 8 shifts in all. Mr. MCCORMICK uses Ingersoll-Sergeant drills and air compressors on this work.

A NEW SEWERAGE SYSTEM FOR WASHINGTON, D. C., has been recommended by the commission consisting of RUDOLPH HERING, SAMUEL M. GRAY

and FREDERICK P. STEARNS. The proposed plan contemplates the discharge of the sewage into the Potomac River and will cost about $3,598,000 to carry out.

A NEW PLAN OF WATER SUPPLY FOR PARIS has been proposed. There are to be two distributing systems—one supplying potable water and the other and larger one furnishing the Seine water for all purposes where purity is not essential. The supply of potable water is to be taken from the Avre Springs, situated near Verneuil, distant about 52 miles from Paris. The cost of the proposed works is estimated at 35,000,000 fr., and the estimated cost of maintenance is 50,000 fr. per annum. A bill is now before the French Chambers providing for the purchase of the Avre Springs.

THE FRUIT HILL RESERVOIR, at Providence, R. I., will probably be repaired at an estimated expense of about $75,000. The report of the examining experts, Messrs. JAS. B. FRANCIS, B. S. CHURCH and J. HERBERT SHEDD, indicates the trouble to have arisen from the seamy character of the ledge underlying some portions of the embankment and from the porous nature of the puddle used for the lining. Ex-City Engineer GRAY thinks such a wholesale reconstruction unnecessary, and states that the present leaks can be stopped by applying concrete to the rock at a total expense of less than $8,000.

THE WATER-WORKS SITUATION AT CINCINNATI shows little or no improvement. The water is slowly falling in the river, which adds to the peril from defective machinery. The experts appointed by the Commercial Club, Messrs. G. BOUSCAREN and CHARLES HERMANY, (the latter appointed in the place of Mr. GEO. HORNUNG, who declined to serve) have begun their investigation.

HOW ELECTRICITY KILLS has been a subject of much discussion since New York's electrical execution law was passed; and the legal squabbles over the carrying into effect of that law developed pretty clearly the fact that no one knew very certainly in what manner a fatal electric current caused death. Recent experiments by Dr. EDWARD PATUM, reported in the *Electrical World*, have proved conclusively that the electric current kills only by stopping the action of the heart. Dr. PATUM sums up the result of his experiments as follows:

1. In death which follows an electric shock so quickly as to be called sudden, the heart is arrested as soon as or sooner than any other serious lesion of tissue or function is produced.

2. When a battery current is used, this cardiac arrest is brought about almost exclusively by some direct action upon the muscular substance of the heart, whereby its power of automatic contraction is lost.

3. When a rapidly alternating current is used, this cardiac arrest is brought about certainly very largely through the physiological cardio-inhibitory mechanism, although even here the direct action on the muscular substance is probably not without importance.

THE SCHIEOPHONE is the name given to an instrument for discovering flaws in metals invented by Capt. LOUIS DE PLACE, of the Paris School of Cavalry, and described in a recent number of *La Nature*. The instrument consists of a microphone combined with a mechanical striker and a sonometer. In using the instrument, one operator directs the striker over the surface of the metal under examination, while another listens at the telephone in an adjoining room. When the striker hits a point over a flaw, the sound is increased; and the increase is so magnified by the microphone that the listener at the telephone can detect its presence. Tests of the instrument were made at Ermont on rails for the Northern Railway Co., and in every case where a flaw was indicated by the instrument it was found to exist on breaking the rail.

THE LAKE FRONT AND JACKSON PARK SITE for the Columbian Exposition at Chicago, seems now certain to be the one used. The Chicago Common Council, on July 23, passed the ordinance granting to the Fair Directors the use of the Lake Front. They must fill in at least 150 acres, which will cost about $12,000 per acre. This will make the Lake Front the principal site of the fair. Exhibits requiring great space will be accommodated at Jackson Park, 8 miles away. The only other official body whose consent to this site has to be secured is the Illinois legislature.

Paving Brick and Brick Pavements.

BY CHAS. P. CHASE, C. E.

[*Continued from page 55.*]

COMPOSITION AND TESTS.

The average composition of fire-clays used for paving brick I find to be 69.1% silica, 15.5% alumina, 5% of chemically combined water, 2% moisture, 2.5% iron, 2.5% magnesia, 3% lime. This is from the analysis of 10 of our best brick, which I give in detail below with accompanying tests of compressive strength.

Hale Paving Brick.

Silica	66.30
Alumina	19.53
Iron sesquioxide	4.07
Lime	1.87
Magnesia	0.42
Moisture at 212°	2.08
Combined water	5.16
Undetermined	0.57
	100.00

Tests of Four Hale Paving Brick.

	1.	2.	3.	4.
Width in ins.	3.60	3.55	3.55	3.45
Compressive	7.42	7.53	7.48	7.43
Surface	2.13	2.17	2.14	2.11
Sectional area in sq. ins.	15.80	16.34	16.01	15.68
First crack in lbs.	36,500	45,500	27,000	36,500
Crushing strength, total	111,200	89,200	66,300	64,600
Pounds per sq. in.	7,038	5,459	4,141	4,120

Failure occurred in detail, bricks flaking off from one side. These brick are furnished to the trade 8 ins. long, 4 ins. in depth and 2¼ ins. wide.

Mingo Fire Clay, Haydensville, O.

Silica	72.24
Alumina	16.87
Magnesia	trace
Alkali	1.09
Iron	0.16
Lime	0.50
Water	5.44
	100.00

This clay in its natural state is quite compact and has the appearance of a fine grained sandstone. The blocks made from it are 5¾ by 5¾ ins. weigh 9¼ lbs., and are salt glazed; in burning they are subjected to a heat of 2,000° F. for 10 days.

Burlington Brick "Granite Brick Company."

Silica	77.40
Ferric oxide	3.29
Alumina	11.74
Lime	1.60
Magnesia	1.91
Potash	3.76
Soda	.47
Mn (trace with FeO)	
	100.17

Tests of Burlington Brick.

Name.	A.	B.
Size in ins.	7 × 3 × 2	8 × 3 × 2
Area of cross section	9.2031	8.6094
First crack in lbs.	40,000	35,600
Crushing strength, total	84,800	58,000
Pounds per sq. in.	9214.3	6736.8

These brick were tested on end. On breaking them they presented a uniform and compact structure, well vitrified. The clay is a hard, blue clay resembling sandstone.

The Bloomington brick are of 3 kinds, classed according to the clay from which they are made.

A. Yellow, aluminous clay, very fine and plastic, found 3 ft. below the surface. In burning it turns to a grayish red.

B. Hard pan clay just beneath A, and lies in a stratum 1.5 ft. thick, and is hard to crush. In burning it turns from pink to a cream color.

C. Is a blue clay directly beneath the hard pan and has a depth of from 1 to 6 ft. and burns to a chalk white.

An analysis of the best Bloomington paving brick gave the following result:

Silica	67.80
Alumina	11.55
Ferric oxide	4.31
Lime	8.90
Magnesia	5.32
Water	0.20
Manganese	trace
Chlorides	trace
Alkali and loss	2.42
Titanic acid	trace
	100.00

Compressive Strength.

Name.	Crushing strength in lbs. per sq. in.
Bloomington "A"	12,920 — maximum
Bloomington "A"	11,520 — mean
Bloomington "A"	10,120 — minimum
Bloomington "B"	9,893
Bloomington "C"	9,386

This test was not made on full size brick, but on specimens ¾ by 1¼ ins., taken from the brick.

In the manufacture, the clay is tempered in a pug-mill, molded into brick by hand, dried in a yard, and burned 96 to 120 hours in up-draft kilns with wood and coal as fuel. The brick are 7 by 3⅛ by 2¼ ins. in size, and sell at $8.50 per 1,000 at the yards. The Virden brick is manufactured at Virden, Ill., the material being a slaty clay found in a layer 25 ft. thick and 175 ft. underground. Its composition is similar to most of the Illinois fire clays. The brick are 8⅛ by 4¼ ins., compact and uniform; when struck, they give out a sharp metallic ring.

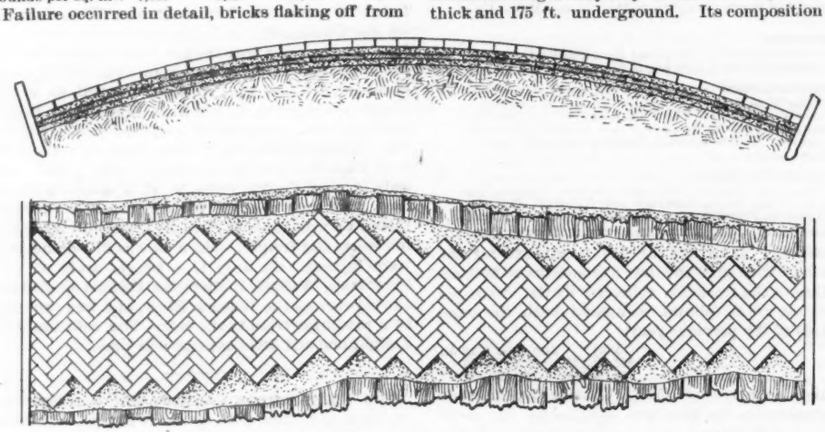


FIG 1.—HALE BRICK PAVEMENT.

The clay is crushed in a dry pan crusher, then placed in a tempering machine from which it is forced in a stream 8⅛ by 4¼ ins., runs over a roller, and is then cut off by hand. It is next placed in drying sheds, and when all moisture is driven off the brick are burned in down draft kilns 70 to 90 hours.

Compressive Strength.

Name.	Crushing strength in lbs. per sq. in.
Virden "A"	10,000 — maximum
Virden "A"	9,680 — mean
Virden "A"	9,361 — minimum
Virden "B"	9,173
Virden "C"	8,862

The next brick we will take up is called a "slate brick," and is manufactured by the American Brick & Tile Co., of Phillipsburg, N. J.

Analysis.

Silica	56.78
Alumina	17.38
Lime	4.34
Magnesia	3.15
Iron peroxide	6.50
Sulphur	0.89
Phosphoric acid	0.133
Water and carbonic acid	7.600
Alkali and organic matter	3.427
	99 910

The clay is crushed and then ground in a pan; one machine having 6 brick in a mold and making 35,000 in 10 hours. The crushing strength averages between 7,000 and 7,500 lbs. per sq. in.

The Myenburg Brick Co. have a brick (patent) into which a material is put to assist in vitrifaction. The brick is hard, smooth, and quite durable.

The Ottawa Fire Clay & Brick Co. use 0.5 fire clay and 0.5 ordinary red brick clay. The clay is well ground, tempered, thoroughly dried, and then burned in down-draft kilns.

When broken they presented an exceedingly com-

pact and uniform structure. The interior was of a gray, metallic color, thoroughly vitrified and very hard. They are more of a block than a brick, being 12 by 3¾ by 5 ins. In street use they have given general satisfaction, and do not wear slippery or shiny. At Toronto, Canada, a slag brick has been experimented with. It is gray in color, 6 ins. long, 4 ins. wide, 6 ins. deep, heavy, very hard and slippery, and costs about 60 cts. more per yard than cedar blocks. This brick comes from England.

The brick made at Empire, O., are of a cream color, quite uniform in structure, and measure 8 by 2⅝ by 4 ins. The clay is a light blue fire clay, and is burned in up-draft kilns, with natural gas as fuel.

At New Brighton, Pa., a good quality of brick is manufactured, which comes up to the standard of a fair paving brick.

Wheeling, W. Va., has a brick which is a combination of iron slag and fire clay; it makes a fair paving brick.

The London Mills brick is manufactured in Illinois, and has given satisfaction where used.

A pressed brick is made at La Salle, Ill., but it is light, porous, contains too much sand, and is not burned hard enough.

The same must be said of the Muscatine paving brick.

In tests on St. Louis brick, Prof. J. B. JOHNSON found a crushing strength of 8,000 to 10,000 lbs., but as I cannot say how the tests were made, this statement is not of much value.

In England, brick made from the Stourbridge fire-clay have quite a good reputation; an analysis of this clay is given below for comparison with our own.

Stourbridge Fire Clay, England.

Silica	73.82
Alumina	15.88
Iron	2.95
Lime	trace
Magnesia	trace
Alkali	0.90
Water	6.45
	100.00

It will be seen that its composition is almost identical with that of our own clays.

Now that we have discussed the merits and strength of different paving brick, we will compare them with different paving stone, mainly granite.

Name.	Crushing strength in lbs. per sq. in. Maximum	Minimum.
Hard brick	22,000	4,000
Limestone	20,000	7,000
Granite	21,000	12,000
Marble	20,000	8,000
Sandstone	15,000	5,000
Trap rock, N. J.	24,000	20,000

And the following results of tests of our different granites will show that there is almost as much difference in the strength of granite as brick.

Tests made on two inch cubes. Crushing strength, granites, U. S.

Name.	First crack in lbs.	Crushing strength; total lbs.	Crushing strength; lbs. per sq. in.
Richmond, Va., 1	30,200	30,200	7,550
Richmond, Va., 2	22,000	30,100	7,522
Richmond Va., 3	28,600	45,280	11,320
Richmond, Va., 4	23,510	25,640	6,410
Marlborough, N. H., 1	13,850	21,900	5,475
Marlborough, N. H., 2	18,290	19,530	4,882
Marlborough, N. H., 3	20,130	20,130	5,042
North Jay, Me., 1	16,880	20,000	5,000
North Jay, Me., 2	17,130	19,140	4,785
Geogia, 1	18,590	20,200	5,050
Georgia, 2	14,870	18,320	4,580
Georgia, 3	17,370	19,500	4,875
Georgia, 4	16,320	17,500	4,375
Georgia, 5	15,700	20,980	5,245
Haynes Stone, Ga., 1		54,450	13,610
Haynes Stone, Ga., 2		49,000	12,250
Beauchamp			
Stone Mn., Ga., 1		49,250	12,312
Stone Mn., Ga., 2		66,000	16,500
Lithonia, Ga., 1		74,650	18,662
Lithonia, Ga., 2		71,900	17,975
Richmond, Va., 1		68,000	17,000
Richmond, Va., 2		70,260	17,565

The first of these tests were made in Cincinnati, in August, 1886; the last eight were made at the Bureau of Ordnance of Ordnance of Navy Department, Washington, D. C., in 1886 and 1887.

In a series of comparative tests of hard burned bricks, made at Budapest, Hungary, the following results were obtained:

Tests made on Cubic Centimeters.

Name.	Crushing Strength. Minimum lbs. per sq. in.	Maximum lbs. per sq. in.
Brick, 5 samples	26,980	30,700
Brick, 3 samples	33,640	39,800
Brick, 2 samples	36,460	45,140 unbroken.
Granite, 22 samples from 3 quarries.	12,340	23,600

It can be seen in the table that the minimum crushing strength of the brick was in no case so low as the maximum of the granite.

In the tests made at Berlin, Germany, on ceramite brick, upon 23 cubes similar to the above, the maximum crushing strength per sq. in. was 52,710 lbs., mean 41,940, minimum 31,170 lbs. These brick average above any natural stone in compressive strength. Of course they were exceptional cases, but they show the possibilities of brick. On examining the preceding tables of analyses, it is seen that the clays that make good paving brick have nearly the same ingredients in the same proportion. Such clays are nearly always to be found in any region where coal exists; if then you find a clay of this composition, a good brick can be made from it if properly worked up. The result of the burning is a hard, tough and slightly elastic brick; really an inferior glass. It will not break in handling, and can be unloaded by dumping from a cart without injury. A vitrified brick is almost impervious to water and other fluids, and no brick should enter a pavement which, when immersed, will absorb more than *one-tenth* of its weight of water in 10 days. The test for absorption is one of the best, and its importance will be illustrated further on.

The following tests for absorption were made on brick thoroughly dried, then immered, and results taken for 3, 5 and 10 days. The specific gravity, which should be 2.0 or more in a paving brick, is also given. The amount of water taken up varied almost directly with the vitrifaction of the brick; in nearly all of the specimens the burning could have been carried a little further to advantage.

Comparative Per Cents. of Absorption of Water.

Name.	Spec. grav.	Brick immersed for 3 days.	5 days.	10 days.
Ottawa, Ill.	2.3507	3.22	3.80	4 12
London Mills	2.2314	3.42	3.78	3.80
Burlington, Ia.	2.2982	0.90	1.10	1.17
Galesburg, Ill.	2.2432	5.32	5 54	5.545
Bardolph, Ill.	2.0300	3.37	3 44	3.45
Empire, O.	2.1700	5.60	5.85	5 864
Le Clair, Ia.	2.1743	2.86	3 12	3.20
Bloomington, Ill., A	2.1852	3.79	3.92	4.06
Bloomington, Ill., B	2 3045	3.18	3.19	3.37
Bloomington, Ill., C	2.2269	1.87	2.20	2.70
Virden, Ill., A	2.3166	3.10	3.12	3 82
Virden, Ill., B	2.4150	7.07	7.06	8.71
Virden, Ill., C	2.3601	7.11	7.48	8.70
Hayden block	2.2871	3.25	3.38	3.64
Common brick	1.8210	15.13	16.06	16 50

All these brick, except the common red brick, come up to the standard of having a specific gravity of more than 2.0, and absorb less than one-tenth of their weight of water in 10 days soaking, the Burlington brick absorbing least. The amount of water taken up varied almost directly with the vitrifaction of the brick; in nearly all of them the burning could have been carried a little farther to advantage.

In a few localities, brick have been used for paving where they were dipped in hot tar, or creosote, to make them impervious to water and frost, but this is only a temporary protection and would only improve a soft porous brick, which, of course, is of no use in a pavement. A vitrified brick would take up practically no tar or creosote.

Whether the brick are soft or hard in the kiln depends much on the skill of the burner; but more on the kiln in which the burning is done and fuel used. Oven kilns with oil for fuel give the most uniform and reliable results.

Having now treated of the composition and values of the different clays and modes of burning, it may be well to enumerate here the machines and number of men necessary to operate a thoroughly equipped brick plant. The complete plant, as used by the Purington-Kimball Brick Co. two years ago, is taken as an example.

One steam shovel for getting out clay, with the capacity of enough clay for 225,000 brick in 10 hours; 4 machine men, 4 machine boys on platform, 8 men at the pulverizer (Cockrell), 2 men at hoisting machines, 1 engine man on steam shovel, 1 fireman, 1 crane man, 6 men in the clay bank, 12 boys loading cars and handling green brick, 4 men to put cars in the dryer, 4 fire dryers, also to take cars out; 4 fire dryers, also to take cars out at night; 24 men setting and wheeling, 1 engineer, 1 fireman, 1 carpenter, 1 blacksmith, 3 laborers. Total, 83 men.

Before burning, the brick are put in drying tunnels and all moisture driven off. These tunnels are 36 ins. wide, 48 ins. high, and are heated by coke. It takes 1 ton of coke to dry 150,000 brick. Crude oil is used as fuel.

Paving brick proper have had their reputation greatly injured by the use for paving of soft, inferior brick, sometimes tarred or creosoted. A good example of this is the brick paving of Nashville, Tenn. Quite a large amount of pavement was laid with creosoted brick; in a little while they began to fail, and soon the whole country knew it. It was not until lately that the writer understood the real cause of the failure. In looking over one of last year's numbers

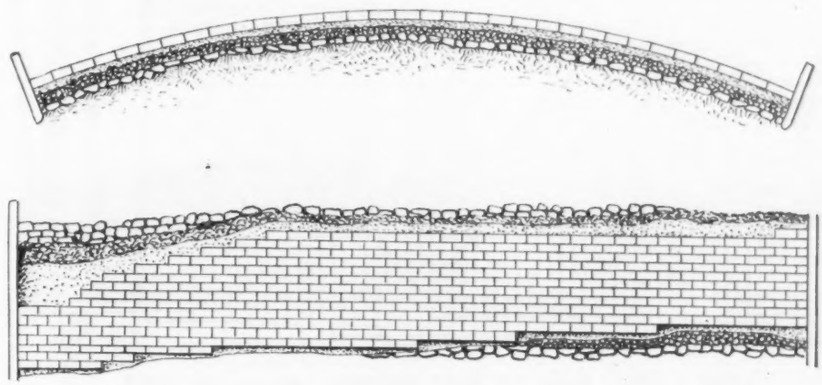


FIG. 2—BRICK PAVEMENT AT CLINTON, IA.

of the ENGINEERING NEWS, an article on the failure of this pavement was found which, after noticing the failure, ended by saying, "The brick were the common red brick, creosoted." No wonder the pavement failed. Common red brick were never intended to resist the shock of heavy carts or blows from steel-shod horses, and a brick that will take up tar or creosote will soon be taking up moisture.

Unjust comparisons are made between granite or sandstone pavements of some of our large cities and brick pavements of the West, the persons making the comparisons forgetting that the first is usually on a hydraulic concrete foundation, and the brick invariably on broken stone or gravel.

Again, as to the economic question: it would not be economical or just to ask a person owning a $1,000 lot in a town of, say, 12,000 population to spend $1,000 or more for a granite or asphalt pavement in front of it; whereas in New York or Chicago the pavements at the same price would be a small item in comparison with the value of the same size of lot.

It is probably owing to this last cause that a foundation peculiarly its own has been adopted for a brick pavement, being generally 7 to 9 ins. of broken stone, well rolled, and a cushion of sand on this. The results obtained have been generally satisfactory.

At Des Moines, Ia., they have about 10 miles of brick paving. The author went over and examined nearly all of it last winter, and it seemed to be in fair condition, although the brick are not as hard as some in use in other places. The streets at that time were in good condition, and as far as slipperiness on grades is concerned seemed to give as good a foothold as any of the other pavements in use there. In laying this pavement the street was brought to the required grade by putting in 9-in. layers of filling

and rolling with a roller weighing 1,800 lbs. to the ft.; then 3 ins. of sand; on this a course of brick was laid flatwise with their longest axis parallel to the street; then a layer of sand sufficient to even up and fill spaces between the bricks, and on this a layer of brick on edge at right angles to the street.

At Bloomington, Ill., the people are unanimous in favor of brick. City Engineer Bell says: "We have tried stone blocks, Nicholas and macadam pavements, and still have samples from which to draw our own conclusions; but the citizens of Bloomington are a unit in favor of brick for future street pavements. The reasons for this are cost, durability, lack of noise and general satisfaction." It may be suspected that Bloomington is a small town and has no heavy traffic; but this is not so. A line of paving running to the depot has been down for 7 years, and all freight to the depot and all the coal from the coal shafts, a very heavy traffic, passes over it; still it shows no appreciable signs of wear.

Some of their pavements are 15 years old, are but little worn, and in good shape, except where they have been disturbed and were not properly relaid. The manner of laying is as follows: Foundation brought to proper shape and well rolled; then a course of cinders is spread on and compacted by rolling; on this is placed 2 ins. of sand, and then the first course of brick on their flat sides, with their long axis parallel with the street. Next comes 1 in. of screened sand, and then a layer of brick

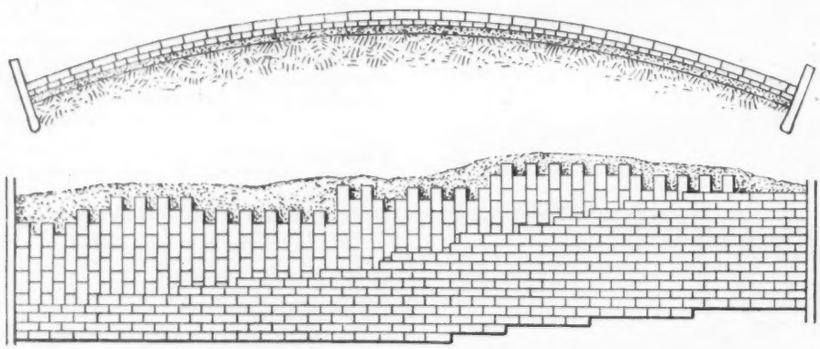


FIG. 3—USUAL FORM OF BRICK PAVEMENT LAID IN THE WEST.

edgewise on their 2-in. surface, and long axis at right angles to the street. The brick are then covered with sand, which is swept into the cracks, and the whole pavement rolled with a heavy roller.

There is no necessity of the sub-course of brick being as hard as the upper course, but care must be taken to break joints in both courses. The entire pavement, including all materials, grading and stone curbs, cost $2 per sq. yd.

Decatur, Ill., lays pavement in much the same way. The specifications in abstract are:

First—Foundation brought to desired crown 12 ins. below grade and rolled with a heavy roller.

Second—A course of clean gravel, none larger than a robin's egg.

Third—One course of brick flatwise, then 1.5 ins. sand and a course edgewise, and brick brought to a surface by striking with a maul on a plank.

Fourth—Sweep in dry sand.

Fifth—Brick are extra hard and vitrified; cost $1.50 per yd.

The oldest brick paving at this place has been down 6 years, and shows but little wear.

At Steubenville, O., hard burned fire brick are used, obtained chiefly from New Cumberland, W. Va., and have given satisfactory results. The brick are laid on foundations of gravel similar to the preceding. The wear is estimated at 0.25 to 0.5 in. in 5 years. Cost, $1 per sq. yd.

The city of Burlington, Ia., has put down 50,000 sq. yds. of brick paving in the last 2 years, and will lay the same amount this season. The citizens are decidedly in favor of brick. Their specifications are:

First—Earth roadbed excavated to required depth, made of the desired shape and rolled, all depressions being filled with sand or gravel.

Second—A layer of gravel or macadam, which is wetted and rolled.

Third—A layer of clean river sand is put on the gravel, and this well rolled and settled by watering.

Fourth—On the foundation thus formed a course of hard brick is laid on the flat side, lengthwise to the street. On this a course of clean sand to the depth of 1 in.

Fifth—A top course of the very best and hardest brick set on edge, their longest axis at right angles to the street, and this course covered with sand enough to fill all cracks, and the whole rolled until it conforms to the required grades.

At Cedar Rapids, Ia., the brick pavements seemed to be in fair condition, although the quality of brick could be improved.

Peoria, Ill., has obtained satisfactory results from their brick paving. Franklin St., which has been paved 3½ years, is one of the principal streets, and has a very heavy traffic. As yet it shows little or no sign of wear, and is as pleasant to ride on as asphalt. The brick used are larger than ordinary, being 4 ins. thick, 12 ins. long, and 5 ins. deep, laid on 5 ins. of rolled gravel, and the joints filled with sand. Contract price, $1.70 per sq. yd.

Davenport, Ia., has some excellent brick paving; it has not been down long, but up to the present time it has been very satisfactory.

At Clinton, Ia., a considerable amount of brick paving was laid last year, but here there were slightly different conditions, which led to another manner of laying the brick. It had been decided to lay two courses of brick, but on cleaning off the dirt on the streets it was found that a hard firm layer of the old macadam paving remained which could be used for a foundation. On this, enough rubble was placed to bring the street to within 8 ins. of the grade of the top of the paving, and this was rolled with a heavy roller; then 2 ins. of earth was spread over the stone, wetted down and rolled several times; on this a 2-in. layer of sand, and then a layer of brick laid on edge, the long axis at right angles to the street. Where there was no macadam to build on, the foundation of stone and earth was prepared, and allowed several weeks to settle and be bedded down by passing teams.

This pavement is but a few months old, so nothing can be said of its wear; but one thing was learned which was of the greatest importance. The last winter being so broken, continually thawing and freezing would, of course, be a hard test for any brick that would absorb much moisture. The brick were carefully examined, and all the brick that had failed were found to be those that had not been vitrified in burning. There were not a large number, but sufficient to show that brick, no matter how hard or compact they are, will not do for paving unless evenly burned and vitrified.

What is known as the Hale system of paving has been quite extensively used in the East, and has given quite satisfactory results. The main feature is a layer of tarred boards for a foundation.

The whole system is: 1st, a layer of sand; 2d, tarred boards; 3d, another layer of sand; 4th, a layer of brick laid "herring bone" style.

The simplest method of tarring the boards is to have a board box say 20 ft. long, 20 ins. wide, and a foot deep; along the bottom of this a steam pipe about 1¼ ins. in diameter is run and returned, a little steam sufficing to keep it hot. A man stands at each end of a board with a pair of tongs and lifts the boards in and out and piles them up ready for use. The boards used should be clear from sap. Where used this has been pronounced a good foundation.

The oldest piece of pavement on this plan was laid in 1873, and is now 17 years old; the boards and the brick are still in good condition, and have been all the time in constant use.

The cost is about $1.25 per sq. yd., and the royalty for using the patent is 10 cts. per sq. yd. A large amount of this has been laid in the East and Southeast.

At the convention of clay workers held recently at Indianapolis, a brick taken from an exposed part of one of the principal streets in Burlington, Ia., was presented for examination. It was estimated that 3,000 vehicles passed over the spot in a day. The expert brick men found it difficult to tell for a certainty which side of the brick had been exposed to the wear and tear of street travel and which had been protected by resting on the sand. There were no marks, no chipping, and no stain to guide a person in telling which side had been uppermost. The brick was thoroughly vitrified, very compact, and would not practically absorb or retain on its surface any ordinary liquid.

In Mr. LOVE'S work on pavements, just published, a number of flattering testimonials are given in regard to brick pavements. But I have found no account of a brick pavement, first-class in all particulars, failing. In Mr. A. H. PERKINS' "Information on Pavements" quite a number of failures of brick are noted, but the kind of brick, composition, manner of burning, strength or absorptive tests are not given, so that the statements are valueless and unjust for comparisons. The reader is led to believe that the brick of 10 years ago are the same as those of to-day, as a review of some of these statements will prove.

Gen. GILMORE is quoted as saying, in 1885:

> It is claimed that bricks saturated with liquid hydrocarbon will sustain great weight without crushing, and will resist abrasion and wear when subjected to ordinary street traffic, but no satisfactory evidence on these points, based upon their practical use, has been obtained.

The statement is all right; but in the 5 years since 1885 it has been proved that a brick which will absorb any liquid is not fit for a pavement.

The report of Captain EUGENE GRIFFEN, U. S Engineer, on brick in 1887, says: "The record of brick is an irregular one," etc. This is too true; but how could it be otherwise when brick are burned in up-draft kilns with the irregular heat of wood as a fuel, and in another place a fire brick used with enough lime in it to disintegrate it; or one company making a brick from coarse clay, another from fine. Again, he says brick may "be burned in the same kiln and by the same workmen," but as before said, wood fires or other than oven kilns cannot be depended on for fine work.

Mr. H. M. CLAFLIN says: "The Topeka people have tested all kinds, and have declared against fire brick. Turning back a few pages, we find this statement. A committee of five eminent citizens report that "The difficulty of uniformity of material, uniformity of burning, the uncertainty as to special kinds of clay required, and the absence of any clay in this vicinity known to be adapted to this purpose, make a brick pavement at this time (1886) in Topeka a very doubtful experiment." I have already answered the questions as to non-uniformity in material and burning. Uncertainty as to kind of clay is also a thing of the past.

On page 16 of the same pamphlet this statement is found: "If one brick in each square yard of pavement be bad, it will make the whole pavement bad." Now in the first place, with our ordinary Western paving brick, one bad brick for a square yard is a very excessive statement, and what is more to the point, it does not make the whole pavement bad, where the streets are kept in any sort of decent shape. A soft or an overburnt brick does not lose its shape entirely, and under any ordinary inspection such a brick would be discovered, and in a few minutes could be replaced by a better one without disturbing the rest of the pavement.

The cut showing the different manner of laying brick are for the purpose of illustration only; the crowning of the street and size of brick being exaggerated, although the relative proportions of the materials are true. Fig. 1 shows the Hale pavement in section and plan; as is seen in the cut, a few triangular brick are used next to the curbs, as the brick are laid herring-bone style.

Fig. 2 shows the pavement laid at Clinton, Ia. The large stone on the bottom are the remains of an old macadam pavement; on this come the broken stone, earth, sand, and then brick.

Fig. 3 is the general form of brick pavement laid in the West, being first soil, then sand, gravel, broken stone or cinders, first course brick, an inch of sand, and then the top course of brick. The under course of brick is calculated to take the place of concrete or other solid foundation. It does very well, considering the item of cost.

Where brick pavements are laid on concrete, the author does not think the brick should be bedded in the concrete, but that there should be 0.75 to 1 in. of sand between. This would be sufficiently firm and yet would give great elasticity.

The following specifications have this feature of one course of brick on an inch of sand, with a concrete foundation. All streets to be paved to have a complete system of drains first put in, and all water or gas main laid which will be necessary at present or in the near future. The street is then brought to the required grade. If necessary to fill, the filling is to be done in 8-in. layers, well wetted and rolled, with a roller weighing 1.5 tons to the foot; on this 6 ins. of hydraulic concrete is to be placed, the concrete being composed of 1 part cement, 1 part clean, sharp sand, and 8 parts stone broken to pieces 1 in. in diameter.

This is to be laid in 2-in. layers. When the concrete is sufficiently hard, an inch of clean sand is spread over it, and evened off by a templet which is to be worked just ahead of the bricklayers.

The brick shall be laid on this sand on their 2.5 in-surface, the long axis at right angles to the street, care being taken to break joints and to lay to a true line.

No half-brick allowed except to start a course at the curb. The brick are covered with sand, which is carefully broomed in.

The pavement is then to be brought to a surface and settled by ramming upon a 2-in. plank, 10 to 12 ft. long, successively over the entire surface. The bricks used shall be 8.5 ins. long, 4.5 ins. wide, and 2.5 ins. in thickness, all to be sound, whole, and burned to the point of vitrifaction. They shall have a crushing strength of 8,000 lbs. per sq. in., shall not absorb more than one-twelfth of their weight of water in 10 days, and must be made from a clay known to contain not more than 5 per cent. of iron and 3 per cent. of lime. The brick to be burned in down-draft or oven kilns.

Samples to be furnished before the contract is let, and if any brick are found which do not come up to these standards, the engineer shall select a number of samples at large, and if these also are below standard, all brick in that lot shall be rejected.

The contractors shall warrant the pavement for a number of years, and agree to keep it in repair for a certain term of years.

The amount of material necessary for 1 mile of pavement in the Hale system and in the one-course system used at Clinton, Ia., is seen in the following tables:

For 2 courses of brick add 50% to the number of brick.

Quantities for One Mile of Hale Paving.

Width of street, in ft.	Surface in sq. yds.	M. bricks.	Cu. yds. sand.	M. ft. lumber.	Barrels tar.
20	11,734	821.38	1,956	105.6	176
30	17,600	1,232.00	2,800	158.4	264
40	23,467	1,642.69	3,911	211.2	353
50	29,778	2,084.46	4,963	264.0	447
60	35,200	2,464.00	5,867	316.8	528
10	41,067	2,874.69	6,845	369.6	615
80	46,978	3,288.46	7,829	422.4	575
100	58,667	4,106.69	9,778	528.0	880

One Mile Paving in Clinton, Ia.

Width of street.	Surface in sq. yds.	M. bricks	Cu. yds. sand.	Cu. yds. rubble.	One course.
20	11,735	950.53	2,933¾	5,867½	First
30	17,600	1425.60	4,400	8,800	rubble
40	23,467	1900.33	5,866¾	11,733½	then
50	29,778	2411 02	7,444½	14,889	sand
60	35,200	2851.20	8,800	17,600	then
20	41,067	3326 43	10,266¾	20,533½	one
50	46,978	3805.22	11,744½	23,489	course of
100	58,667	4752.03	14,666¾	29,333½	brick.

The author is indebted for much valuable information to ENGINEERING NEWS, the "Michigan Engineers' Annual," to the city engineers of Burlington, Ia.; Decatur, Ill.; Bloomington, Ill.; Virden, Ill., and Messrs. D. W. MEAD, J. P. HALE, W. W. NASH and I. O. BAKER.

[In addition to this article, which is perhaps the most complete yet printed, other valuable articles may be found in the files of the ENGINEERING NEWS which we may appropriately refer to here: General descriptive articles have appeared May 7 and Nov. 19, 1887, May 31 and Aug. 3, 1889. Tests have been recorded in the numbers for May 14, June 9, 1888; Feb. 2, March 30, May 4 and June 28, 1889; June 21, 1890. Articles on the wearing of brick pavement were published Feb. 2, May 25, June 15, and Dec. 21, 1889; June 7, 1890. The manufacture and methods of laying were described March 1, 1890. Specifications were given in the issues of March 8 and 29, 1890.—ED. ENG. NEWS.]

Weston's "Triplex" Spur-Gear Pulley-Block.

The Yale & Towne Manufacturing Co., of Stamford, Conn., makers of the well-known Weston "differential" pulley-block have just placed on the market an extremely novel form of pulley-block which has been perfected by Mr. WESTON after several years of experimental work. This block is wholly unlike the "differential" pulley-block invented by Mr. WESTON 36 years ago. While that block was of the simplest possible construction, the new block is quite complicated, more so perhaps, than any other now on the market.

FIG. 1. Weston's "Triplex" Spur-Gear Pulley-Block.

The chief object sought in its design has been to obtain the highest possible efficiency, and therefore, the purchase is obtained entirely by spur-gearing, consisting of a triple purchase, and a triple "sun-and-planet-wheel" motion.

The mechanism of this block, which has been named the "triplex," is plainly shown in the accompanying engravings:

Fig. 1 shows a perspective view of the complete block; Fig. 2 is a transverse view, the lower half being shown in section; and Fig. 3 shows the central pinion engaging with the planet-wheels which drive the lifting sheave.

Referring now to Fig. 2, it will be seen that all of the mechanism is symmetrically grouped upon a single horizontal axis. Power is applied to an endless hand-chain passing over the pocketed chain-wheel

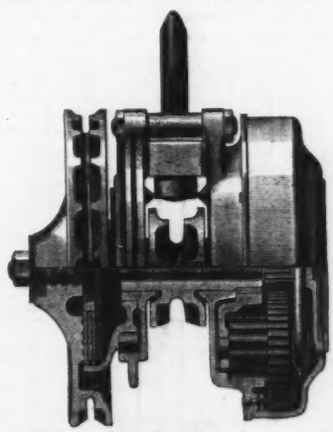


FIG. 2. Half Section and Half Elevation of "Triplex" Block.

on one end of the central shaft, and is transmitted thereby to the train of spur-gearing contained in the housing on the other side of the block. The main or load-chain passes over a pocketed chain-sheave in the center of the block, one of its ends being provided with a suitable hook for receiving the load, and the other being looped up and permanently secured to the frame of the block. The latter arrangement diminishes the length of the slack chain and prevents it from fouling.

The hand-wheel at the left transmits power through the central shaft to the steel pinion on its opposite end (seen best in Fig. 3), which in turn engages with the three planet-wheels surrounding it

FIG. 3. Spur Gearing of Triplex Block.

These latter are of hard bronze and have cast with them a smaller series of pinions, shown in Fig. 2, which latter engage with the annular gear cast in the stationary frame of the block, as shown in Fig. 3. The three double planet-wheels are carried in a frame or cage which supports both ends of each of the pins forming the axes of the wheels. As the central shaft is turned, the whole cage and its three pinions thus rotate slowly within the housing of the block. Referring to Fig. 2 it will be seen that the inner side of the pinion cage consists of a disk keyed to one end of the steel sleeve forming part of and carrying the hoisting chain-sheave, so that the rotary motion of the pinion cage is thus transmitted to the chain-sheave. The two hubs of the latter are prolonged to form bearings on each side in the frame of the block, and are bored through the center to permit the shaft of the hand-chain wheel to pass through the sleeve thus formed. The mechanism for preventing the block from running down when the hand-chain is released and for lowering by a reverse movement of the hand-chain is as follows:

In Fig. 2 it will be seen that the hand-chain wheel is screwed onto a sleeve keyed to the central shaft. When power is first applied to hoist, the effect is to screw the hand-wheel against the series of friction plates shown in Fig. 2, which in turn bear against the disks rotating with the central shaft and carrying with it a roller-check mechanism fitting into a recess formed in the left-hand frame of the block. The construction is such that so long as hoisting continues, the small steel rollers of the checking mechanism offer no resistance; as soon, however, as hoisting ceases, and the load causes reversion of movement, these rollers mount on their inclined paths and frictionally check the frame which carries them, preventing its further rotation. This frame in turn locks one set of the friction disks and prevents them from turning; the other set of disks, being frictionally engaged with the first, also remain stationary, and, by their friction, prevent the hand-wheel from turning backward. The load thus remains automatically sustained, and cannot run down unless power be applied to the hand-chain.

Lowering is accomplished by lightly pulling on the hand-chain. The effect of this is to unscrew the hand-wheel on its sleeve, the latter remaining stationary for a moment under the influence of friction and inertia. As soon as this is unscrewed enough to release the two sets of disks from frictional engagement, the set which is carried by the sleeve of the main chain-wheel begins to rotate backward under the impulse of the load. This motion, overtaking that of the other set of disks carried by the hand-wheel again forces the two sets into frictional engagement, and tends to check the descent of the load. The continued rotation of the hand-wheel, however, will again release the friction on the disks and again permit a further lowering. The makers say that in point of fact, these successive releasings and engagements occur at such short intervals as to constitute a practically continuous movement whereby the load descends smoothly and quietly as long as the hand-chain is kept in motion. So long as the backward motion of the hand-chain continues, the device just described operates smoothly and noiselessly, permitting the load to run down at rapid speed, *but*

COMPARATIVE EFFICIENCY OF SEVERAL PULLEY BLOCKS, TESTED BY PROF. R. H. THURSTON.

WORK OF HOISTING. (Load of 2,000 Pounds.)				NUMBER OF BLOCK. (All Blocks of One Ton Capacity.)	WORK OF LOWERING. (Load of 2,000 lbs. lowered 7 ft. in each case.)					
					Exclusive of Factor of Time.				Incl'sive of Time	
Waste by Friction. Per cent.	Actual Efficiency. Per cent.	Relative Efficiency.	Velocity Ratio.		Pull on Hand ch'n. Lbs.	Length of Hand ch'n. Feet.	Work performed. Ft. Lbs.	Relative force expended by operator.	Time in Minutes.	Relative Efficiency.
20.50	79.50	1.00	32.50	1 (Weston's Triplex.)	8.00	227.	1,816	1.00	0.75	1.000
68.00	32.00	.40	62.44	2	14.00	436.	6,104	3.33	1.20	.186
69.00	31.00	.39	30.00	3 (W'ton's Differential)	92.30	196.	18,090	10.00	1.50	.050
71.20	28 80	.36	28.00	4 (Weston's Imported.)	92.60	168.	15,556	8.60	2.50	.035
73.96	26.04	.33	48.00	5	73.30	17.5	1,282	0 71	2.80	.380
75.00	24.34	.31	53.00	6	56.60	370.	20,942	11.60	1.80	.036
77.00	23.00	.29	44.30	7	55.00	310.	17,050	9.40	2.75	.029
81.03	18.97	.24	61.00	8	48.50	426.	20,000	11.60	3.75	.018

without acceleration, and with a pull on the hand-chain which does not exceed 8 to 10 lbs. when lowering the maximum load. If the pull on the hand-chain be discontinued, the lowering action will cease. The pull required to lower is so light as to easily permit of "spinning" the hand-chain, thus obtaining a fly-wheel effect, and enabling lowering to be accomplished at high speed. This motion, however, can be controlled or instantly checked by the application of a slight resistance from the hand.

The triplex block of 1-ton capacity has a minimum distance between hooks of 16.7 ins., and weighs 89 lbs. Its price is $40.

In October last the Yale & Towne Co. secured the services of Dr. R. H. THURSTON, of Cornell University, to make a series of experiments upon this new block to determine its efficiency as compared with several other blocks now competing for favor in the market, including the Weston differential block. The following is extracted from Prof. THURSTON'S report:

I purchased in the open market a one-ton block of each of the following makes: Weston "direct" differential, of Yale & Towne make; Weston differential of English make (imported); Harrington; Box; Teal; Olsen; Wharton and Batt.

The purchase of these blocks was made from dealers without any intimation that the blocks were for a special purpose. I also received one new Weston "Triplex" spur-gear block, which I found to be in ordinary condition, ready for use, but in no way specially prepared for testing. Every block when received was carefully inspected to make sure that it was in good normal condition for use, and was then well cleaned, thoroughly lubricated, tested to make sure that it was in good working condition, and then subjected to the tests.

It was observed that all, except the Weston "Triplex" block, employed some form of gearing or purchase having a very low mechanical efficiency, and that in most cases the quality of being self-sustaining, which is characteristic of this class of blocks, was due to the excessive friction of the mechanism. As a rule these blocks have a high velocity ratio, and are compact, useful, very handy and light, but are exceedingly wasteful of power, most of them utilizing only from 20 to 30 per cent. of the applied power.

The new Weston "Triplex" block, on the contrary, has a very simple and compact triple train of spur-gearing, and this develops a remarkable high efficiency as compared with any of the older types of chain blocks. Its efficiency is so high, indeed, that it becomes impossible to rely upon the friction of the apparatus to sustain the load. For the latter function a separate and simple friction device is introduced.

In all the older blocks I found that a considerable effort was required to *pull a load down*, as well as to raise it, the amount of this pull, in the case of a load of 2,000 lbs. ranging from 92 lbs. down to 41 lbs., except in one case where it was only 14 lbs, but where the velocity ratio of the block was relatively high. In the case of the "Triplex" block with a low velocity ratio, this pull was only 8 lbs.

The measure of efficiency in *lowering* may be stated by taking account of the pull required on hand-chain and of the length of hand chain which must be overhauled to lower a given load through a given distance. The product of these two factors would represent the foot-pounds of work performed. Experience shows, however, that in order to fully and fairly compare the lowering efficiency of different blocks, it is also necessary to introduce the element of *time*, for the reason that the length of chain which must be overhauled and the speed with which it is possible for the workmen to handle it largely affect the time during which the workman must continue his exertion to lower a given load through a given distance.

I have deemed it best, therefore, in the table of lowering efficiencies to show both the work performed in foot-pounds and also the relative efficiency of the several blocks, including the element of time.

Referring to the construction of the "Triplex" block, I find it to be compact, strong, well designed and well made, throughout, an excellent example of good engineering and shop work. It occupies much less vertical space than any other, and its weight is only slightly greater than that of its best competitors. Many of the other blocks are much slighter, and therefore of less weight than the Weston "Triplex" block; but the moderately greater weight of the latter is evidently due not so much to the inherent solidity of its design as to the fact that it possesses a large factor of safety. If the other blocks were all made equally safe under their maximum loads, I would expect to find the weights of many of them greatly increased.

Other things being equal, we may safely assume that the durability of a block is directly proportionate to the efficiency of its train of gearing or other means employed to obtain mechanical power, and inversely proportionate to the amount of applied power which is used up in the friction of the machine either in hoisting or lowering. The hoisting efficiency of the "Triplex" block being from 2¼ to 4 times greater than that of others, the wear resulting in its hoisting should be only ⅝ to ¼ as much. A still greater difference exists, however, in the wear due to friction in lowering. In other blocks the friction of the working parts is depended upon to prevent the load running down, and this friction must be overcome during lowering, and thus tends to wear out the mechanism. In the "Triplex" block, on the contrary, an independent friction device is employed to prevent running down, which adds little or nothing to the friction of the machine when hoisting, and which is so adjusted as to require a very slight effort to overcome its friction when lowering.

It is reasonable to infer, therefore, that the "Triplex" block will outwear any of its competitors, and that experience will show it to possess an endurance at least 5 to 10 times greater than some of them.

The New Rails of the Berlin Railway.

An experimental increase in the rail sections of the City Ry. of Berlin will soon be made, and if the new shapes wear well, they will be adopted on the whole of that line as well as on many systems where the traffic is very large.

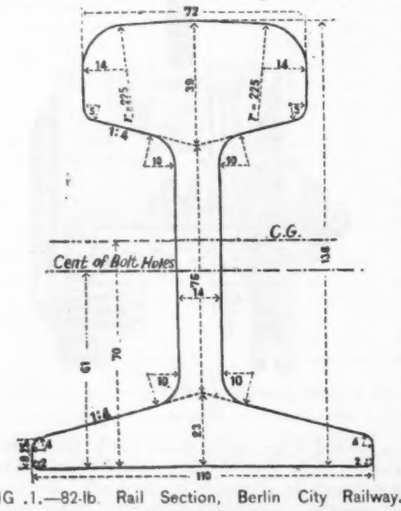


FIG. 1.—82-lb. Rail Section, Berlin City Railway. (Half Scale.)

The City Ry. is especially adapted to such trials since trains run every 5 or 10 minutes over its intricate track. The locomotives are of the six-wheel tender type, and the cars run on four fixed wheels. The speed of the trains averages 28 miles an hour.

Since the wear of the sides of the head of the old rails was very great (due undoubtedly to their large corner radius, 0.56 ins.) the new head is considerably wider, 2.83 ins. The neck and base have been increased to correspond, and the section now weighs 86.7 lbs. per yd.; the base is very narrow, 4.33 ins. for a height of 5.43 ins. The cross-ties are to be spaced 3 ft. apart, center to center, except at the ends of the rails, where they will be but 2 ft. apart, the joints being suspended. The length of the cross ties will be increased from 8.2 ft. to 8.9 ft.

The rails will rest on bed-plates 6⅛ ins. longitudinally by 7½ ins. wide, as shown in Fig. 2. Each

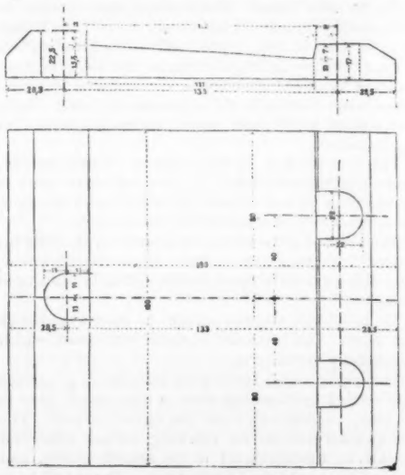


FIG. 2.—Tie Plate for 82-lb. Rail, Berlin City Railway (One-third Scale.)

plate will be fastened to the tie by three screws, two of which will be inside the rail. The ends of the rails are to be supported by a bridge joint (see Figs. 4, *a-e*), very much like the Fisher pattern; in fact, so far as appears, identical with it. We give herewith drawings of the rail section and bed-plate.

Train Dispatching; Its Uses and Abuses.

We condense the following from an interesting paper by Mr. G. C. KINSMAN, Superintendent Telegraph Wabash R. R., read at the Ninth Annual meeting of Railway Telegraph Superintendents. Mr. KINSMAN'S chief point—that running trains off schedule time seriously increases the dangers of train operation, especially where the block system is not in use—is one which needs to be forcibly impressed upon American railway managers. As we scrutinize the accident records from week to week, it is impossible to escape the conviction that one of the most fruitful causes of train accidents is trains running out of time. This evil has been seriously commented upon of late, because of the injury which is thereby done to the traveling public, which expects trains to adhere to the schedule. But if the public only understood that it doubled the hazard of railway travel to have trains running out of time, there would be even more said about the matter in the public prints.

President SHINN, of the American Society of Civil Engineers, in his address at Cresson (ENGINEERING NEWS, July 5), said that trains upon our leading lines are less prompt and regular than they were 20 years ago. If this be true, it is time a reform was started. Mr. KINSMAN'S paper is important also as showing that delays to freight trains are not so unimportant as regards safety as generally supposed.

My first office was on a Western road. There were but 3 regular freight trains each way upon the time table, although from 10 to 15 were usually run.

Freights and, occasionally, passenger trains were delayed hour after hour at my station, and I was an

enforced listener to all sorts of uncomplimentary remarks about the train dispatcher on duty, and train dispatching in general, many arguments and improved methods being advanced by the train crews during these frequent hours of waiting.

One bright fellow advanced time orders, and was thereafter the subject of ridicule, it never having occurred to these men that the schedule was nothing more nor less than a time order to each train named upon it.

It is hardly necessary for me to say that we have outgrown the old systems and prejudices; we have not only discovered that time orders are safe, but that they are absolutely necessary.

The matter of moving trains by telegraph has been discussed until many of our best men are growing to believe that there is no other way to get trains over the road promptly, and are placing their sole dependence upon it, to the utter neglect of more important methods. Let me say here that, while no important single track railroad (and this paper is not intended to apply to any other) could at this time move a large traffic successfully without train dispatchers, their work is greatly overdone, and the tendency is to still further increase it.

On many roads freight trains are started from terminals at any and all hours, with little regard for the time table, and the train dispatchers expected to get them over the road promptly and safely. Regular trains are held at terminal and way stations for all sorts of trivial reasons, necessitating many train orders and other delays, and the officials fume because of late trains, blockades and other accidents.

Some officials seem never to learn that about the only source of revenue to a railroad is that part of its property which moves on wheels, and that it is, therefore, of vital importance that they be kept turning. To do this there must be system, and that system lived up to every hour in the day and every day in the year. Eternal vigilance is the price of good service in the matter of moving trains, but, in addition to this, two things are necessary, first make a time table that trains can run by, then run the trains by it.

Many will argue that this can be done only where the volume of traffic is moderate and regular, and where there is an abundance of power. These are the officials who, when a rush of business overtakes them, fill their yards and passing tracks with surplus loads, start trains from all points whenever they can be gotten ready, without any regard for the time tables; keep their crews on the road 20 hours out of 24, and abuse the dispatchers because the trains are laid out.

A good dispatcher is a valuable acquisition to any railroad, but it is not in the power of any set of dispatchers to succeed under the circumstances just named; they may work and worry, and incur risks which make them gray, but at the end of the month it will be found that, although every nerve has been strained, the average time made by trains has been slow, and that the greatest increase has been in the pay roll and the accident account. The latter must necessarily increase, as the men are overworked, and as system and order decrease.

A time table which has been carefully checked by the proper officials before being printed, and by hundreds of employés afterward, must be more reliable than a telegraphic order in any event, and especially so when the latter is handled in great haste and often by inexperienced operators.

We must therefore assume that with every special order we incur an additional risk; it has been stated by those who have studied the records, that 70% of the collisions in this country happen to trains moving on special orders, and although I have no means of knowing, I do not doubt it, for I do not know how it can be otherwise.

The greater the volume of business, the more need of moving trains on schedule time. There is no wisdom in saying it can't be done; it can. If the schedule is wrong, change it; if power is limited, shorten the time as much as safety will permit. Train men like to start on time, and their families like to know when they will be home. System will secure competent and reliable men; the opposite will drive them away. To more forcibly illustrate the point I have sought to make, I will present a few figures prepared from the records of the company which I have the honor to represent, giving the record of train movements in the month of January, 1890, and in the same month 5 years ago.

	Freight train mileage.	Pass. train mileage.	Train orders issued.	Ave. speed freight trains. (Miles per hour.)	Ave. speed pass. trains. (Miles per hour.)
Jan., 1885 ..	611,928	311,399	55,720	9	25
Jan., 1890....	606,421	382,106	17,285	13	29

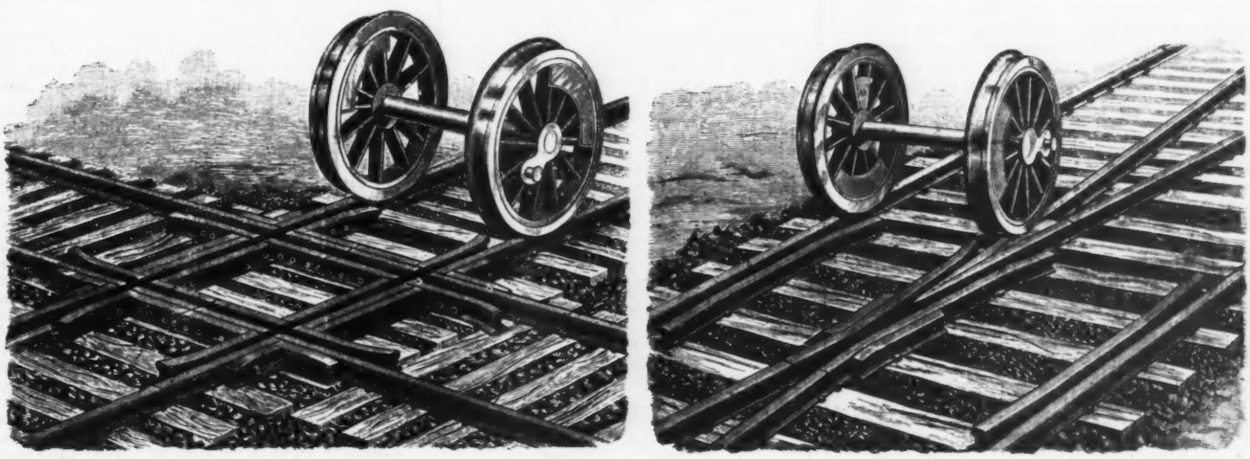
In the former case, 40 per cent. of the regular trains were late; in the latter, less than 10 per cent.

This statement covers 1,921 miles of road, the same lines in each case. It is proper for me to state, however, that this improvement is not all due to the fact that we are running our trains by the time table. The physical condition of the property is much better than it was in 1885; there was no surplus power then, nor is there now, nor has there been in the aggregate any considerable increase in the side track or terminal facilities. It is particularly noticeable, however, that system and regularity in everything has developed a painstaking care on the part of the trainmen which makes accidents rare.

I should like to say a few words concerning the uniform system of train orders adopted by the Time Convention, and now in effect upon many large roads. Every road, so far as I can learn which has taken it up squarely and lived up to it, is satisfied, and would not go back to the former system.

The principal criticisms which I have heard are that the system is slow and cumbersome, and that there is too much red tape about it. Dispatchers are, as a rule, anxious to avoid even the slightest delay, and their zeal is apt to outrun their foresight, and induce them to give too many orders. It is well, therefore, if the system is cumbersome enough to prevent this, and if the official who is using the old system (or neglecting the new) would disguise himself and see how his orders are being handled on the road, he would wish for tape of a still brighter hue.

It may be slow, but with it we have moved more than 1,000 cars per day (in addition to 30 regular passenger trains) over a crooked single track road, every day in the month, without any serious delays or complaints from the dispatchers.



At a Right Angle Crossing. At a Frog.

PLAN FOR SUPPORTING HOLLOW TIRES.

Dangers of Hollow Tires in Contact with Frog Points.

By T. H. PERRY, Chief Engineer Lake Erie & Western Railroad.

Worn or channeled tires or wheel treads are now well understood to be among the most dangerous features of railway operation. The accompanying cuts show clearly the real character of these defects and their destructive tendency.

a, *b*, *c*, Fig. 1, represent several positions of a wheel facing a frog point; *d*, trailing it. Wheels facing frog points, are by their outer rim acting as a flange along the outer edge of the wing rail, strongly urged to follow the wing rail, from their normal line, position *a*, to that of *b*, where further progress in that direction, as of *c*, is only arrested by the outer channeled flange being forced arbitrarily to mount the wing rail and cross it safely to the frog point, by the opposite wheel firmly held against further yielding of the guard rail. The horizontal strain exerted by the channeled wheel following the wing rail and the opposite wheel against the guard rail striving to arrest it, is, for the moment, a contest

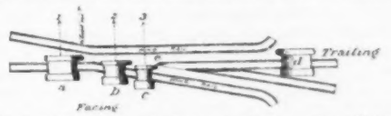


Fig. 1.—Hollow Tire Facing and Trailing a Frog Point.

between safety and derailment, and one quite liable to end in derailment if the guard-rail be badly set or if it yields.

The position *b* is shown to be a common one by the sheared points of frogs, shown at *e*, and this shearing is done by the gauge flange of the wheel being drawn over as above noted.

The guard rail, as a preventative of this calamity, can only be fully relied upon in the event of both wheels having similar channels, giving an equal pull one against the other. While wheels generally channel alike, there are many exceptions to the rule; and, moreover, if the car happens to be oscillating just right, from defects of level or otherwise, the wheels on one side are largely relieved of strain, and so have much less resisting power. It is by no means rare, moreover, for the hollow to have a much sharper edge on one side than on the other as well as to be deeper. Under these circumstances the guard rails become of vital importance, and only the best construction and maintenance of those members will enable them to withstand the shock.

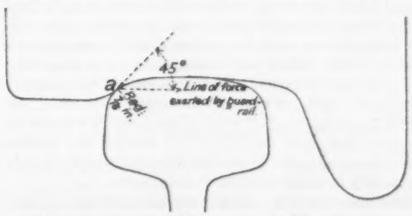


Diagram of Hollow Tire on Wing Rail of Frog.

As we do not have to go far for data to determine the strain on the guard rail, and, consequently, on the frog members and wheels involved, I submit them with the following diagram, showing the position of a hollow tire when the guard rail has to force it over.

I hope that some of your readers may be interested in giving a formula for its solution. The only factors that are not noted on the diagram are: That the point of contact, *a*, will be at the divergence of the wing rail, of say a No. 9 or No. 10 frog, 6° 27′ and 5° 44′ respectively; that the guard rail wheel be con-

sidered as a plain face tread, so that the horizontal pull necessary to raise the outer flange onto the face of the wing rail shall be wholly exerted on the guard rail; that the weight on each wheel be 14,000 lbs.; the diameter of wheel at point of contact a, be 5 ft. 6 ins., and that its speed be 60 revolutions per minute.

Destructive and dangerous as we know these strains to be, they would be absolutely eliminated by simply constructing a frog with a width of face equal to the wheel tread, which would be far better than persisting in the present method of heavily bolting and clamping to resist them.

Frogs are the only points throughout the entire railroad plant, where the wheel is made to work without regard to its best and safest service, and any improvement that will make the wheel and frog independent of each other; and dependent on their owns merits, will be an advantage to permanent way and equipment.

The Proposed Diamond Shoals Lighthouse.

(WITH INSET.)

Cape Hatteras has an unenviable reputation all over the world as one of the most dangerous points known to seamen. It projects much further out to sea than any other point along the coast, the Gulf Stream comes far nearer to it than to any other point along the coast—at times within 20 miles of it—tending to make the weather fitful and stormy, and also to drive vessels as close as they dare go to the shoals, the frightfully dangerous character of which is sufficiently evident from the accompanying map, there being for eight miles or so out a continuous irregular shoal, with from 10 to 30 ft. of water over it.

This shoal tends to quickly create a heavy sea, and so aggravates the difficulty of navigation, which at times is extreme. As a consequence, there is perhaps no point in the world where there have been so many wrecks within the past century as here; and it is one of the serious elements of doubt which contractors have to face that the caisson when sunk, may strike the bones of some old wreck which will delay and imperil the work, as well as increase its cost.

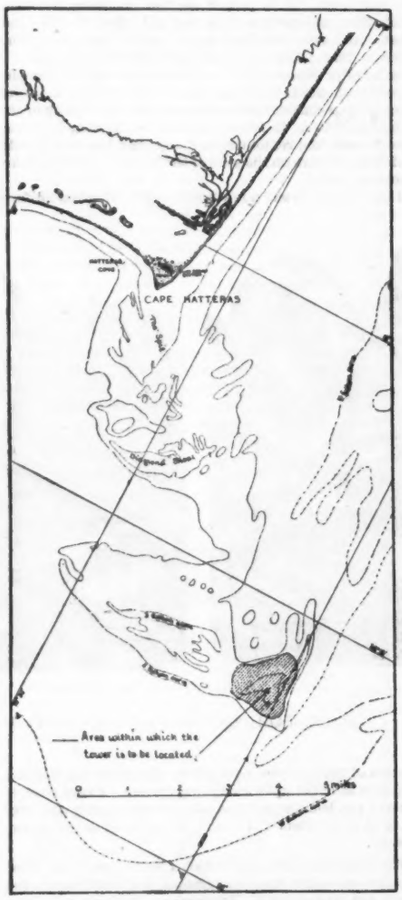
The sea is so rough, and the bottom (largely composed of a shifting sand) so poor that it is quite impossible to anchor a light-ship here, or even a buoy, with any assurance that it will remain in position. Neither is a skeleton or screw pile structure to be thought of; such are expressly excluded. A lighthouse has long been desired, but it is only lately that the experience and plant have existed for attempting it with reasonable hope of success. It is needless to say that, in the present state of the engineering arts, putting up a lighthouse on any kind of an exposed or submerged rock would be child's play in comparison. A further contingency which has to be provided for is, that the shoals are constantly shifting, and that the depth of water around the light-house may possibly vary within a range of 40 or 50 ft. in as many years, in addition to which great scour from the waves may be induced.

As a consequence, in order that no unwary or incompetent bidders might interfere by tenders which they could not carry out, to the Government's loss and their own, the specifications were made unusually severe, and very wisely and properly, we think. The bidder must take the entire risk himself, prepare his own plans, furnish all the capital and plant, and not only get no money back until the work is complete, but until it has been in use and in service one year, during which period the bidder must maintain it. In a sense, these terms are hard. It clearly intends to exclude poor men,

But the theory of the Government plainly is that poor men should acquire capital by the successful execution of less exposed and doubtful works, on which monthly estimates are freely given before attempting a work of this character, in which lack of judgment or experience may so easily lead to total failure to the Government's loss and their own. Had this driven away all bidders, of course, the policy would have had to be abandoned, but if bidders can be had on these terms, it strike us as better for all interests in the end that they should be enforced.

Certainly the policy was effective in securing bids from responsible parties and such only. Four bids were offered, as listed in our issue of July 5, and all from men of such experience and standing in the execution of great engineering works that the Government's interests would be safe in the hands of any of them, we may reasonably assume. We present herewith the general plans for three of these bids (to be followed by further details next week) these being the only bids which the Light House-board was at liberty to consider, since they were the only ones coming within the legal limit of $500,000. Messrs. Lindenthal & Andrew's bid of $1,820,300, was for a very much larger and more massive structure, which they believed was necessary, if the structure was to stand forever, and of which we hope to be able to give some details later.

Under the Government specifications the contractor is to make all surveys, borings and soundings himself, and has a range of about one square mile, within which he can pick out his own site at discretion. The material is supposed to be sand to a great depth, we understand, but even this is not stated. There



Map of Cape Hatteras and Vicinity. Showing Location of Proposed Lighthouse for Outer Diamond Shoal.

Reproduced from Coast Survey Chart.

is a current as high as 4 knots per hour after heavy gales. Fixed conditions were that the focal plane should be 150 ft. above low water (tide rising only 18 ins.), that riprap blocks shall not weigh less than 2 long tons each, that the first floor shall be at least 30 ft. above water, and that there shall be eight floors. There must be storage room for 30 tons of coal, 6 cords of wood, 8,000 galls. of fresh water, 3 life boats, and about 500 cu. ft. of mineral oil, with stores for four men for a year. The fourth and fifth floors are for bedrooms, the sixth for a kitchen, the seventh for a sitting-room, the eighth for a service room below the light. The floors are to be so sealed by trapdoors that fire cannot go from one to the other. The details about the superstructure are quite explicit; for the substructure, almost nothing.

We postpone the publication of the parts of the specifications relating to the foundations until our next issue, when we shall give more detailed drawings of them. The parts of the specifications relating to the towers proper are as follows, so far as they relate to matters not prescribed by the Light-house Board.

Messrs. Anderson & Barr describe their tower as follows:

The tower is of slightly bell-shaped form, 40½ ft. diameter, at bottom, and 19 ft. diameter at top, below the main gallery prescribed.

It is constructed of cast iron plates, varying in thickness from ⅝ in. for the bottom course to 9-16 in. in the top course, provided with ample flanges and brackets for fastening the plates together, and for receiving the iron floor beams.

The bottom course of the tower is provided with a well-bracketed flange, which is bolted to the base ring, and through which also passes a number of anchor bolts, with plates at their lower ends, in the concrete, long enough to receive the effect of the weight of the brick lining of the tower.

All the floor beams are of wrought iron. Those forming the second and third floors are supported by two columns and a stringer beam. These floors are formed of brick arches. The upper floors are formed of hollow floor brick.

The inside of the tower is completely lined with brick work, kept separate from the iron structure, in order to avoid ill effects from differing expansions. The lower part of this brick tower is 24 ins. thick and the thickness gradually decreases so that the seventh story is lined with 12 ins. of brick, and the eighth story with 8 ins. The chimney is built in this brick lining, the top finishing out into a metal chimney as per specifications.

The storage vaults asked for under the first floor, are to be of cylindrical shape, 9 ft. 8 ins. diameter, and 9 ins. height, with arched top and manhole frames and covers. Two of these are built in cast iron, flanged and bolted together to serve for the fresh water tanks. Four more are built in brick in the same shape, and form the coal and wood storage; and another 17 ft. deep with 6 ft. diameter of upper opening, contains the steam pump. The suction pipe of this passes through the side of the caisson and downward on the outside into a cast iron protecting strainer box held in the riprap blocks.

Mr. WM. SOOY SMITH specifies for his tower as follows, its most notable feature being that it provides for a far heavier tower than either of the other two plans:

The superstructure shall join the vertical cylinder described at an elevation of about 37 ft. above low tide, where it shall be 36 ft. in diameter. It shall extend upward a distance of 86 ft. 6 ins., where it shall be 19 ft. 6 ins. in diameter. From thence it shall extend upward, vertically, 13 ft., from which level shall rise the watch-room and lantern, the lamp of which shall have its focal plane at an elevation of 150 ft. above the low tide. The watch-room shall be surrounded by a gallery 27 ft. 6 ins. in diameter. The entire outer surface of the superstructure, with exception of doors and windows, shall be of cast iron plates, of the same general specifications as those in the vertical cylinder of the foundation. The number of plates in each section and their height shall be varied to accommodate the needs of the different stories. Their thickness shall vary from 1¼ in. for the bottom section to ¾ in. for the top section. They shall be bolted together and packed in the same way as those for the foundation cylinder. A circular brick wall shall extend throughout the entire height to the gallery floor. It shall vary in thickness from 5 ft. 6 ins. at the bottom to 2 ft. at the top. The brick shall be good hard burned brick, laid in Portland cement mortar, which mortar shall have the proportions of one part of cement to three parts of clean sharp sand.

The floor of the first or landing story shall be of cement mortar 3 ins. thick; of the second or machinery floor, 12-in. I-beams and brick arches covered with 3 ins. of cement mortar; of the third story, 9-in. I-beams and hollow tile arches of the usual fireproof pattern, covered with 3 ins. of mortar. The floor of the fourth and all upper stories shall be of the same construction as that of the third story, with the exception that they be covered with 2 ins. of mortar, in which shall be set wooden strips 2 ins. square, to which the wooden floors shall be fastened.

There shall be furnished with the lighthouse 3 boats of approved pattern, 25, 20 and 18 ft. long respectively. These shall be stored on the first floor and suitable gearing and tackle shall be provided as shown on the drawings, for handling them, either by hand or steam power. There shall be on the second floor a double fog-horn and engine for operating same; a vertical boiler of 12 HP. capacity, together with necessary tools and attachments for operating same; a steam pump which may be connected with any of the various water tanks, and a Kriebel hoisting engine.

Messrs. Theodore Cooper & Co. give the following brief specification only for the lighthouse, apart from the foundations, first briefly outlining the latter:

The proposed lighthouse will consist of three distinct divisions: 1. The supporting caisson. 2. The monolithic sub-base. 3. The light tower proper.

The caisson will be formed of timber, thoroughly bolted and tied together and provided with a wrought-iron cutting edge.

Its form will be octagonal, the inscribed circle of the top being 50 ft. in diameter, and of the cutting edge, 51 ft.

8 ins. diameter. Its total depth from cutting edge to roof will be 11 ft.

Its proportions have been determined by consideration of the requirements of strength and required area of base for such a structure as is proposed, and from the needs of sufficient buoyancy and stability to be towed and managed from its proposed place of construction, inside Hatteras inlet, over the bar of this inlet and to the proposed site. Any increased size beyond that demanded by these requirements would only increase unduly the hazards of the proposed operations.

The monolithic structure above the caisson will be 40 ft. in diameter, up to the line of low water. From there it will be conical in form for an additional height of 11 ft. and 6 ins., at which point it will have a diameter of 32 ft. The remainder, up to 30 ft. above high water, will be a cylinder of 32 ft. in diameter.

It will consist of a wrought-iron shell securely fastened to the top of the caisson and filled with hydraulic cement concrete laid in the open air, the wrought iron shell acting as a cofferdam during the progress of the work. The upper portions of this iron shell may be made of cast iron, if such may be preferred by the Lighthouse Board.

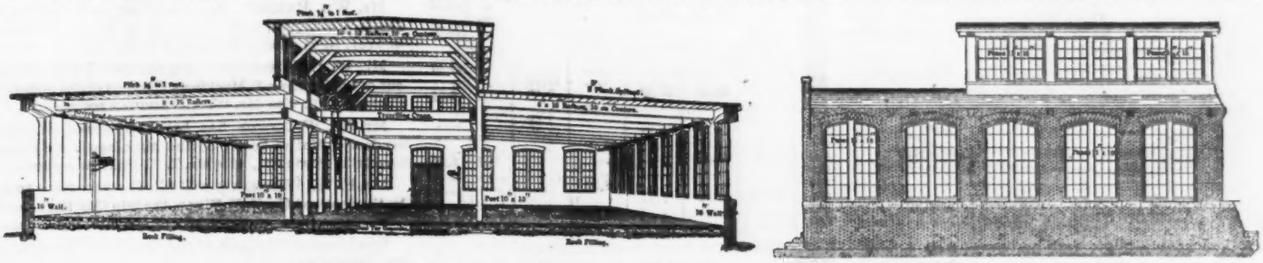
Vaults will be formed in the upper portion of th is monolith for the storage of coal, water, and the salt-water pump. The necessary pipes and drains will also be built into the work where required.

The light tower will consist of a cast iron shell lined with brick, with the necessary windows, doors, floors, stairways, gallery, watch room, etc. The same to be fitted and furnished in accordance with the detailed requirements of the specifications issued by the Lighthouse Board. It will be securely anchored to the subbase. Its focal plane will be 150 ft. above low water.

The light tower will be of cast iron lined with brick, and be entirely fireproof. It will be built in accordance with the technical requirements of the specifications of the Lighthouse Board, and be equal in every respect to similar structures built by the Lighthouse Board.

Examples of Slow Burning Construction: Foundry and Machine Shop.

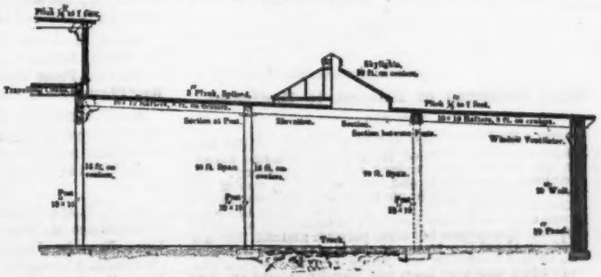
We take the following illustrations from a recent circular issued by the Boston Manufacturers' Mutual Fire Insurance Company, showing a machine shop and a foundry built by the slow burning system which has proved so great a success in the construction of larger mills and factories subjected to a greater fire risk.



MACHINE SHOP BUILT ON THE SLOW-BURNING CONSTRUCTION SYSTEM.

The foundry roof has no lodging place for dust, if a sloping cover is placed on the small portion of beams under the skylights. The stringing beams hold the alternate roof beams by iron stirrups, and should be 10 × 15 ins. The roof plank should be slightly raised at the left of the skylights.

The window ventilator is made by removing a row of lights from a window and securing to the inside an inclined sash in a suitable frame and with hinged cover having an overhanging edge. It does not interfere with the light or motion of the sash, can be opened or closed at will, and the air being directed against the ceiling it does not produce drafts.



SECTION OF FOUNDRY, SLOW-BURNING CONSTRUCTION SYSTEM.

The following brief notes on construction which accompany the circular are by Mr. C. J. H. WOODBURY, M. Am. Soc. C. E., Vice-President of the company:

For establishments on cheap, level land, especially where the stock is heavy, one-story buildings have proved to be more economical in cost of floor area, supervision, moving stock in process of manufacture, and repairs to machinery—many kinds of which can be run at greater speeds than when in high buildings.

Such buildings are readily warmed and ventilated, and heavy plank roofs are free from condensation in cold weather; the large window area reduces the hours of artificial illumination.

Forced circulation of heated air is a very desirable method of heating a mill, being economical as to maintenance and repairs, and thoroughly under control. Overhead steam pipes are very satisfactory, if used in the ratio of one foot of 1¼-in. pipe to 70 cu. ft. of air.

It is convenient in machine shops to provide rails extending the length of the building under the roof timbers for the purpose of clamping counter-shafts to these rails as may be desired.

FLOORS.

Floors over an air space or on cement are subject to dry rot. Asphalt or coal-tar concrete is softened by oil, and

Window Ventilator.

the dust will wear machinery, unless covered by flooring. Floors made by laying sleepers on 6 ins. of pebbles, tarred when hot, then 2 ins. tarred sand flush to top of sleepers and covered by double flooring, have remained sound since 1865; but double flooring at right angles can be laid on the concrete without the use of sleepers, and nailed together. It is usually preferable to secure nailing strips to stakes 4 ft. apart each way and driven to grade, concrete flush to top of strips, and lay single 1⅛-in. flooring.

WALLS.

Piers reach to roof timbers, and light walls to window sills are finished with slope on inside. In some instances, it is preferable to build brickwork up to the window sills, and support the roof by square posts filling the spaces between the windows, and which are secured to the beams by timber knees or iron brackets. Large windows are placed high, and the sashes separated by a mullion. Lower sashes should be stationary and glazed with rough glass, with transom sash or window ventilators above. If the light is too strong, apply to glass zinc white and turpentine.

The swinging sashes in monitor can be moved in groups by bell cranks from a shaft turned by an endless screw. The connection should not be rigid, but flexible steel links or springs should be introduced to provide for the sashes being out of line, and also to close them with an amount of yielding pressure sufficient to prevent any jarring.

COLUMNS.

Wooden mill columns, Southern pine or oak, safely sustain loads of 600 lbs. per sq. in.; a square column is stronger than a round one of the same diameter. They should have a 1¼-in. core bored from end to end, and two ¼-in. holes through the column near to each end.

The columns should be securely held at each end, the base resting on iron plates projecting above the floor level and the caps at the top bolted to the roof beams.

ROOFS.

Double or solid timbers of Southern pine support the roof plank, and the ends pass through the wall, and are finished as brackets to the cornice. The beams are anchored to plates in the walls by means of tongues which project into grooves across the lower side of the beams. Beams should not be painted or varnished until thoroughly seasoned.

The roof plank should be two bays in length, breaking joints every 3 ft. There is no need of gutters, but a concrete walk, sloping toward drains, will take the water from the roof. Do not drive nails upward into the roof plank, as moisture will condense and drop from the heads.

The Geological Survey of Missouri.

From advance sheets of the report of State Geologist ARTHUR WINSLOW, to Gov. D. P. FRANCIS, we make the following abstracts of progress in the geological survey of Missouri up to May, 31, 1890:

The detailed mapping of the coal fields has progressed steadily, and the field work covers 400 sq. miles. Work on the building materials and clays of St. Louis has been vigorously pushed during the latter half of the month, together with an inquiry into the nature and extent of dependant industries. As showing the interests involved there are in and about St. Louis alone, 8 fire-brick and sewer-pipe manufactures, 40 common and pressed brick establishments, 6 potteries, 1 terra-cotta manufactory, 2 terra-cotta lumber manufactories, and 40 stone quarries. The value of the annual output of the clay industries is now about $3,000,000, and the quarries can not fall much short of $1,000,000.

The coal-beds of Platte and Clinton counties are of economic value, and there is every indication that the 22-in. coal seam mined near Leavenworth, Kan., and others found at different depths, extend under these counties. At Leavenworth, its depth below the surface is about 700 ft.; but eastward into Missouri it must rise progressively toward the surface. Systematic and detailed work can alone determine the limits and depths of these beds.

In Crawford County iron ore still occupies a prominent place in its mineral products. Some of these deposits are exhausted, however, and others are approaching that condition. New sources of supply are demanded, and thorough geological work may lead to new discoveries. Zinc and lead mining are also being investigated here.

In Morgan County there are prospects of a revival in lead mining, with more advanced methods than heretofore. Zinc mining is also being started in this county, notably at "Big Three Shaft," about 5 miles southwest of Versailles.

A New Magnetic Ore Separator.

Mr. G. S. FINNEY, of Philadelphia, has recently nvented a magnetic ore separator which differs from all other similar machines in several respects The Edison apparatus, the leading ore separator now before the public, consists of a series of magnets under which the dry granulated ore is slowly passed. The iron is attracted to the face of the magnets and in this way freed from impurities. The new machine, however, works in a totally different manner.

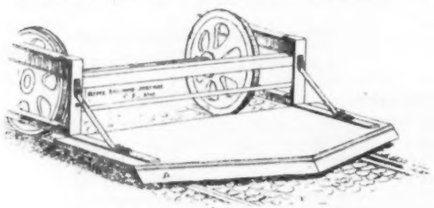
The chief novelty is the magnet. This is formed by winding insulated wire on an iron core, and then heading the latter with iron plates, so that the finished magnet resembles a large spool of covered wire in which the wooden core has been replaced by a similar one of iron. It will be seen that an electric current through the wire will make one plate

of the magnet a positive and one plate a negative pole. These two heads are prolonged toward each other by a series of metallic bars, every second bar being connected with the positive and the others with the negative head. In this way the surface of the cylinder becomes powerfully magnetic. This cylinder is connected with a similar one of wood a few feet from it by a cloth belt. A hopper is placed under the magnet and kept filled with water. Into this hopper the powdered ore is poured. The magnet pulls the metallic iron or oxide of iron to the belt; this revolves, carrying the ore upward and over to the cylinder. Here it is deposited in a shallow basin filled with water in which the lower part of the pulley runs, the friction of the water being sufficient to thoroughly clean the belt.

Several important modifications of the apparatus have been made which greatly increase its efficiency. The theoretical efficiency of a machine with a 4-ft. belt is about 1.16 tons of ore an hour. The practical value has not yet been accurately determined, although a small machine, running with a 2-ft. belt, has successfully worked 7 tons a day. A good ore will sometimes give a very pure product, one sample from Welden, N. J., running 98% of peroxide. The inventors lay great stress on the fact that the ore is worked in a moist condition, claiming that the water washes away a large part of the powdered silica before the mass comes into the magnetic field, thus reducing the work of the magnets. The patents for the machine are held by the Rotary Magnetic Ore Separator Co., of Chicago, Ill.

A Safety Street-Car Fender.

With the rapidly increasing use of cable and electric cars for city passenger traffic it has become advisable to attach some form of fender to the car truck to take the force of any collision, and throw any obstruction from the track. A common form of fender is made of wrought iron rods like a miniature locomotive pilot; and however well calculated it is to clear the track of obstructions, it is also well adapted to break the limbs of any person hit by it, and it often forces him down upon the paving. The safety car fender illustrated herewith is in use on cars in Kansas City, St. Louis and Chicago. An object struck by this fender is picked up and carried along with the car instead of being forced under the wheels. The front of the fender carries a strip of narrow 4-ply rubber belting, marked *A* in the illustration, which is stiff enough to exert considerable resistance, but will pass over any firmly fixed obstruction like a projecting paving stone.



A Safety Street-Car Fender.

We reproduce the accompanying cut from the *Street Railway Journal*, and gladly give it credit therefor, in the hope that the next time it copies a cut from ENGINEERING NEWS as elsewhere noted, it will at least have reformed enough to refrain from placing its own stamp upon it.

Delta Metal.

According to *Glaser's Annalen*, delta metal is a very old alloy, having been known to the old Egyptians. It was first prepared, however, in a scientific manner by ALEXANDER DICK, a German, in 1882. This metal is an alloy of copper, iron and zinc, resembling aich-metal and sterro-metal, which contain the same elements, and are largely used for heavy guns.

The delta metal is prepared by taking advantage of the fact that melted zinc will dissolve about 9% of its weight of iron. The saturation point of the zinc depends upon the temperature of metals during the process—the higher the temperature the greater the amount of iron absorbed. At a white heat nearly 20% is taken up. The fluid alloy is then mixed with an amount of copper or copper and tin, which varies according to the purpose for which the metal is intended. The oxides present are removed by the addition of a small quantity of manganese, usually in the form of copper-manganese alloy.

This metal is tough like wrought iron and has a golden color; it can be drawn into wire and rolled either hot or cold. At a dark-red heat it is easily welded and stamped, by which process it is said to become 50% stronger than wrought iron. When melted it is very fluid and can be easily cast, the castings being uniformly dense and showing a fine crystalline fracture on being broken. The melting point is 1,750° F. and the specific gravity is 8.6. It is said to be less affected by the air than phosphor bronze, brass or red bronze. One of its leading excellences is that it perfectly withstands the action of salt water.

Prof. UNWIN has made some tests of copper and its alloys with the results shown below. In these tests the yellow metal was composed of 60% copper and 40% zinc. The copper was the best Australian metal; the phosphor bronze contained 90% copper, 9.5% tin and 0.5% phosphorus; the red bronze contained 88% copper, 10% tin and 2% zinc.

RESULTS OF TESTS OF COPPER AND ITS ALLOYS.
Breaking weight in tons per square inch.

Temp. Fahr.	Rolled.			Cast in sand.			
	Copper.	Yellow metal.	Delta.	Delta.	Brass.	Phosphor-bronze.	Red bronze
Air	17.84	24.09	31.16	23.39	12.45	16.06	....
210	17-41	....	....	....	....	....	11.66
258	....	22.44	....	....	....	....	....
260	....	....	28.30	....	....	....	....
270	....	....	....	....	....	14.16	....
300	16.43	....	....	....	....	....	....
310	....	....	....	23.36	....	....	....
350	....	....	....	....	11.83	12.26	....
380	....	....	....	....	....	....	12.26
400	....	21.23	26.58	....	....	....	....
406	....	....	....	....	....	....	11.06
410	15.95	....	....	22.48	....	....	....
430	....	....	....	....	....	12.41	....
440	....	....	....	....	....	....	12.30
450	....	....	....	....	10.40	....	....
500	15.09	18.33	23.83	....	7.69	11.10	7.84
506	....	....	....	19.68	....	....	....
550	....	....	....	....	7.68	....	....
570	....	....	19.32	....	....	....	....
590	....	....	....	16.00	....	....	....
600	14.30	15.86	....	....	....	8.17	5.22
615	....	....	....	....	....	....	4.82
635	....	....	....	12.70	....	....	....
640	13.70	14.49	....	....	....	....	....
645	....	....	....	....	3.23	....	....
650	....	....	16.04	....	....	....	....

Owing to the difficulty with which the metal is attacked by impure water, it is said to be eminently suited for metal boats. Such vessels have been used with great success in Central Africa. Its more usual applications will be in gear wheels, propellers, stuffing-boxes, and similar articles. The directors of some of the rack railways in Switzerland have made experiments with steel and other metals to be used in the gears on their lines. The results of these experiments, as stated in the *Polytechnisches Centralblatt*, have been so favorable to delta metal that it will be exclusively used for such parts hereafter.

At present the cost of delta metal is nearly the same as that of brass.

Legal Decisions of Interest to Engineers.

Crossing Railway Track Ahead of Train.—A rag peddler found a street blocked for quite a distance except along the tracks of defendant railway company. He drove along the gangway and was run into by one of defendant's engines before he could get off. The engine was running at the rate of 15 miles per hour, while the legal rate was only 6 miles per hour. A presumption of contributory negligence does not arise because plaintiff did not look to see about the train, as he was on a public street where he had a right to be. There are risks which the most prudent man may take, and plaintiff is not barred of recovery if he took the course most prudent men would have taken. (Kelley v. Missouri Pac. Ry. Co., Supreme Court of Missouri, 13 S. W. Rep., 806.)

Acceptance of Street Improvements by City Authorities.—Where one contracted to do certain work for a city under the supervision of the city's engineers, and it was so supervised, and after completion of the work it was accepted by the authorities of the city as required, the city cannot avoid payment upon the ground that the work was improperly performed. (Brady v. Mayor of the City of New York, Supr. C. of New York, 9 N. Y., Supp. 893.)

Issuance of Bonds by Town in Aid of Railway.—The fact that a town in Illinois can only incur a debt for corporate purposes will not invalidate bonds issued in aid of a railway, on condition that the shops of the company be located at such town. (Casey v. People, *ex rel* Patton, Supreme Court of Illinois, 24 N. E. Rep., 570.)

Right of City to Grant the Use of Streets to Private Corporations.—The power granted by the statutes of Missouri to cities "to regulate the use of streets" will not authorize the council of cities to grant private corporations the right to maintain railways for their own business across streets in such cities. A citizen who is damaged by such railway crossings can enjoin it as a public nuisance. (Glaessner v. Anheuser-Busch Brewing Co., Supreme Court of Missouri, 13 S. W. Rep., 707.)

PERSONALS.

Col. T. W. LONG, a well known Western civil engineer, died recently at Tacoma, Wash.

MR. J. W. HILL, of Cincinnati, O., has been appointed Consulting Engineer of Van Wert, O., waterworks.

Mr. W. A. VAUGHAN has been appointed General Superintendent of the East Tennessee, Virginia & Georgia Ry.

Mr. R. G. WARD has been appointed Roadmaster of the South Carolina Ry, vice Mr. C. W. CROCKER, resigned.

Mr. DARWIN THAYER has resigned his position of Superintendent of the Dunkirk, Allegheny Valley & Pittsburg Ry.

Mr. W. KERRIGAN, formerly General Superintendent of the Missouri Pacific R. R, died recently in St. Louis, Mo.

Brig. Gen. D. T. VAN BUREN, who died recently in Plainfield, N. J., was engaged in civil engineering from 1855 to 1861.

Mr. F. P. MORRIS has been appointed Engineer of Maintenance of Way of the Toledo Division of the Pennsylvania R. R.

Mr. C. B. HUNT has been appointed Assistant Engineer of the District of Columbia, vice Mr. W. K. SCHOEFF, resigned.

Mr. F. W. CRAM has resigned his position as manager of the New Brunswick Ry. His successor is Mr. H. P. TIMMERMAN.

Mr. WM. BARTON, the organizer and builder of the Troy & Lansingburg R. R., and for 20 years surveyor of Troy, N. Y., died in that city July 12.

Mr. W. J. MARTIN has been appointed Superintendent of the Saginaw & Mackinaw Division of the Michigan Central R. R., vice Mr. W. A. VAUGHAN resigned.

Mr. ED. WILLIAMS has been appointed Superintendent of Motive Power of the Minneapolis, St. Paul & Sault Ste. Marie Ry., vice Mr. T. H. FRASER, resigned.

Mr. F. W. WHITLOCK will fill the vacancy caused by the death of Mr. F. F. WELD, the late City Engineer of Waterbury, Conn., until the latter's successor is appointed.

Roadmaster CORBELT of the Delaware Division of the Erie Ry. has resigned his position to become Superintendent of Transportation of the Chicago & Illinois R. R.

Mr. RUDOLPH HERING has been engaged by the city of Victoria, B. C., to examine into the comparative merits of the several schemes proposed for the sewerage of that city.

Mr. DONALD MCLEAN, recently General Manager of the Wyoming & Pacific Improvement Co., has been elected President of the Nebraska & Western R. R., the Nebraska division of the Pacific Short Line.

Mr. J. NELSON TUBBS, of Rochester, N. Y., resigned the position of Chief Engineer of the water-works on July 17. He was Constructing Engineer of the works when built, and had been in charge since 1872.

Mr. A. E. ALBY, formerly Assistant Engineer of the Elmira Bridge Co., has been chosen General Manager of the Fire Proof Floor Co., the manufacturers of the floor illustrated in ENGINEERING NEWS for April 26, 1890.

Mr. F. KIMBALL of the New York State service is making a hydrographic survey of Lake Chautauqua. The legislature has ordered the lake to be dredged near its outlet and the survey is preliminary to advertising the work.

Mr. F. T. HATCH has been appointed Engineer of Maintenance of Way on the Pittsburg, Cincinnati & St. Louis Ry., vice Engineer KITTREDGE, who goes to the Cleveland, Cincinnati, Chicago & St Louis Ry. as Assistant to the chief engineer.

Mr. W. J. ALLEN, General Superintendent of the Chicago, Rock Island & Pacific Ry. lines west of the Missouri River has been appointed Assistant General Manager of the whole system. Assistant General Superintendent DUNLAP takes Mr. ALLEN's place.

Mr. JAMES W. QUEEN, who died in Philadelphia, Pa., July 12, founded the well known house of James W. Queen & Co. in 1846. When, in 1870, he sold out to Mr. Fox, the present owner, the company was the leading concern handling scientific instruments in the world.

NEW PUBLICATIONS.

BOOKS.

—*Recollections of General Grant;* with an Account of the Presentation of the Portraits of Generals GRANT, SHERMAN and SHERIDAN at the U. S. Military Academy, West Point. By GEO. W. CHILDS. 12mo, flex. leather, pp. 104.

—*Practical Sanitary and Economic Cooking Adapted to Persons of Moderate and Small Means.* By MRS. MARY HINMAN ABEL. The Lomb Prize Essay. Cloth, 5 × 9¼ ins., 199 pp. Published by the American Public Health Association, 1890.

This is the fifth prize essay put before the public through the generosity of Mr. HENRY LOMB, of Rochester, N. Y., and judging from its table of contents and index it will do quite as much as the others, if not more, to promote the public health and welfare of America.

—*The Strains in Framed Structures, with numerous practical applications to Cranes, Bridges, Roof and Suspension Trusses, Braced Arches, Pivot and Draw Spans, Continuous Girders, etc.; also Determination of Dimensions and Designing of Details, Specifications and Contracts, Complete Designs and Working Drawings.* By A. JAY DUBOIS, C. E., Ph. D., Professor of Civil Engineering in the Sheffield Scientific School of Yale College. Fifth edition, revised and greatly enlarged. New York, John Wiley & Sons. 4to; pp. 530, 28 folding plates, 305 cuts, numerous unnumbered tables, well indexed. $10.

The first edition of this work, published in 1883, contained 390 pages, 202 cuts and 7 plates. The subsequent issues have undergone alterations and additions until now the fifth edition contains the liberal additions shown above, thus forming the largest work on the theory and construction of bridges ever published in this country. The page is quarto, measuring about 9 by 12 ins., inclusive of margins, and the weight of the volume is 5 lbs. 4 oz., a weight, we may add, which might well have been made less by some curtailment of the luxurious margins, which now aggregate about half the total area of the page.

The book consists of two parts, the first, of 314 pages, being on the computation of strains and the general theory of structures, and the second, of 209 pages, on the determination of dimensions and the designing of bridges. There is a full table of contents as well as the full index noted. Inasmuch as the work is widely known among engineers and in technical schools, it will here be only necessary to dwell particularly upon the new and special features that characterize the present edition. The very fact of the existence of a fifth edition shows that the plan and the contents of the book have met with approval, and the industry and energy displayed by the author in bringing it to its present state of perfection certainly deserve much commendation.

The principal change made in the first part of the work is the omission of the tables for computing strains due to certain locomotive wheel loads and the substitution therefor of the analytical method now in common use by bridge companies. In a paper on American Railroad Bridges, by Mr. THEODORE COOPER, read before the American Society of Civil Engineers in July, 1889, it is stated that the principles and application of this method were worked out independently but simultaneously by Mr. ROBERT ESCOBAR and Mr. THEODORE COOPER in 1880. This paper gives a brief outline of the method, and states that it had never before been published. It will, however, be found, credited to Mr. COOPER, in BURR'S "Treatise on Stresses," published in 1877, in MERRIMAN'S "Roofs and Bridges," 1888, and in a paper by Prof. SWAIN in the Transactions of the American Society of Civil Engineers, 1888. Prof. MERRIMAN gives the diagram used by the Phœnix Bridge Co. for tabulating the shears and moments due to each locomotive, and the same procedure is followed by Prof. DUBOIS. The tables of the former editions were practically useless, as they were for one particular locomotive; but by the excellent method of diagram the student is able to readily deduce the stresses caused by any locomotive wheel loads that may be specified. We have heretofore expressed the opinion that this precision of specification is rather worse than useless, since it implies a degree of accuracy that does not exist, and we feel compelled to still adhere to this opinion; yet the fact remains that students must be taught to compute stresses for any loads which the railroad companies may see fit to require, and should have the ability to do so anyway. It certainly is not a harmonious congruence that the exact position of imaginary locomotive wheels to cause maximum shears and moments should be determined, when it is absolutely sure that such a typical machine will never cross the bridge, or that if it did counterweight and vibratory strains would never use the same load twice within a large percentage, and tolerably sure that heavier loads will cross it within a few years after its erection.

The second part of the work has been considerably altered and much new matter added. The straight line formula for struts is given, as well as the more usual formulas of GORDON and RANKINE. Pins, eye-bars, riveting, wind bracing and miscellaneous details receive much attention, and numerous tables for use in designing columns and the floor system are given. There is, in fact, no text-book in the English language which contains so many illustrations of the details of bridges. There is a chapter on specifications, one on the design of a pin-connected bridge of 153 ft. span, one on shop drawings, one on the order book of materials and one on bridge erection, all seeming to be of a very practical character.

The author has been assisted by MORGAN WALCOTT, C. E., formerly with the Phœnix Bridge Co., and thus has incorporated into the book many features of direct practical value. The running notes, explaining the reasons for the requirements of COOPER'S specifications, will be found valuable to students; the Phœnix table on page 381 for computing weights of eye-bars is an excellent practical model; the chapter on shop drawings gives matter that will be useful to many teachers, and the remarks on shipping and inspection will be interesting to engineers as well as students.

The last chapter in the book, entitled The Erection of Engineering Structures, is by JOHN STERLING DEANS, M. Am. Soc. C. E., of the Phœnix Bridge Co. It is a clear and interesting presentation of an important subject concerning which almost nothing has heretofore appeared in print, and it will be read with interest by all bridge engineers. It treats of the tools, materials, piling, crabs and jacks in a general manner and then gives the detailed methods and plans for the erection of plate and lattice girders, through spans 85 to 100 ft., deck spans 85 to 150 st., spans 150 to 350 ft., spans 300 to 600 ft., draw spans, viaducts, elevated railways, roofs, ocean piers, and cantilevers. This chapter alone is illustrated by 21 plates and by several cuts.

The specifications given in Chapter IX. are those of THEODORE COOPER, which, having been published in pamphlet form by us for many years, are well known throughout the country. Students who follow these specifications will not need to use the methods of designing a piece according to the ratio of maximum to minimum stress by the formulas of LAUNDHART and WEYRAUCH, a subject to which the author devotes much space in earlier pages. COOPER'S method allows for live load strains a working stress per square inch of only about one-half that used for dead load strains, and the sections due to each are to be computed and added to give the total section. This is a good method, although it is liable to objection from those who believe in the value of WÖHLER'S experiments. WOLCOTT'S notes to these specifications are, as before remarked, valuable.

The great value of this book lies in its fullness and the large field which it covers. The author has industriously drawn information and methods from all sources. BOW'S Economies of Construction furnishes seven excellent plates showing the application of the graphic method to roof trusses. BOVEY'S Applied Mechanics gives 22 fine proplems on graphic statics. MERRIMAN'S method of treating the continuous girder is stated almost in full. WADDELL'S isometric view of a pin-connected truss and his list of members are given prominence, and other authorities are liberally drawn upon for tables, methods and even for particular demonstrations. Thus almost every point likely to turn up in the student's mind will be here found discussed, not always in its right place, nor with the best logic, but generally in a fairly satisfactory manner. The book as a reference work for the young engineer is excellent; for the young student, perhaps, it will be found at times too profuse and indiscriminating.

We call attention to two or three points which seem erroneous or curious. On page 66, after having stated that the pressure of wind in pounds per square inch is given by $\left(\frac{v}{20}\right)^2$ where v is its velocity, it is mentioned that if the wind impinges upon a surface oblique to its direction the normal pressure is $\left(\frac{v \sin i}{20}\right)^2$ where i is angle of inclination; but this is directly contradicted by the formula and tables on the preceding page. On page 319 it is stated that RANKINE'S formula for columns applies to all sections except "hollow round;" surely this formula is universally used for Phœnix columns and other annular cross sections. On page 320 it is stated that a sliding factor of safety $4 + \frac{l}{20d}$ is used for variable loads on wrought iron struts. This use must certainly be ancient and rare, and it is properly omitted in COOPER'S specifications.

The term "floor beam" is usually employed in this country to designate the beams that support the stringers of a bridge, but the author generally uses "cross-girder" instead. He also often says "flange" instead of "chord," and "girder" instead of "truss," thus indicating a tendency to British rather than American technical terms. We notice also that he uses "formulæ" as the plural of "formula;" we think this practice should be dropped. "Formula" is now as much of an English word as "Mamma," and there is just about as much sense in retaining the Latin form of plural for one as there would be for the other.

The formulas for the dead weight of girders and trusses presented in a paper before the American Society of Civil Engineers three years ago by Professor DUBOIS are here fully given, together with tables for facilitating their use. A formula is also established for determining the most economic length of span when several spans are to be built between two abutments, and the cost of a pier is known. Wind strains in trestle bents are discussed, as also the subject of skew portals. The author is to be congratulated on the great amount of valuable and interesting matter contained in this volume.

The seven plates at the end of the book give the strain sheet and working drawings for a single track through Pratt truss of 153 ft. span, erected by Kellogg & Maurice on the Missouri Pacific R. R. In Chapter X. of Part II. the author gives "the figuring necessary to design this bridge on the basis of COOPER'S specifications." It is scarcely necessary to say that precisely similar results are not attained, but the author states that "by comparison it will be seen what differences in design we obtain," and "the student should be able to make his own working drawings to suit the new results." As this is the first experience, presumably, of the student, it might perhaps have been better to have printed plates giving the dimensions deduced by the computations; or it might have been as well to do the figuring according to the specifications used in the actual bridge. But the student who makes the comparisons and drawings will have a very valuable exercise.

The analytic method of computing strains due to locomotive wheel loads is the principal addition to this edition, which will increase its value as a text-book. The other numerous alterations and additions, although of value, will be less so to the student than to the engineer. As an extreme instance, the excellent and exhaustive chapter by DEANS on erection adds nothing to the volume as a class book, for it is descriptive matter that the student cannot digest and apply in his own problems, and time is not sufficient to fully cover other important subjects of stress and design. But for the private study of the young engineer, and for the reference of all engineers, these additions render it a more valuable and standard work than before. Prof. DUBOIS has combined theory with practice more fully and more satisfactorily, we think, than any other author on the subject of bridge construction.

The great defect of the book is the neglect of the subject of cantilevers, and this is the more remarkable because the theory is simple and could have been presented in a dozen pages. Beyond a brief popular description and cut the author has nothing, but DEANS in the chapter on erection gives several pages of excellent matter with illustrations. The determination of maximum moments and reactions due to dead loads and locomotive wheels is undiscussed, as also is the economic lengths of shore, river and center spans. The importance of the subject certainly calls for its discussion in text-books.

REPORTS.

—*The Public Works of Philadelphia.* Pamphlet 6×9 ins.; 566 pp. Extracts from this volume will be found elsewhere in this issue.

Papers read before the Engineering Society of the School of Practical Science, Toronto; 1889-90.—Pamphlet 112 pp., illustrated. Papers are principally devoted to questions in sanitary engineering and surveying, but the pamphlet also contains papers on Ontario Cements, Scale Calculus, Masonry Foundations, Cable Railways and Mill Rollers.

Institution of Civil Engineers' Papers.—"The Action of Quicksands," by WILFRED AIRY; "Lough Erne Drainage," by JAMES PRICE; "Railway Bridges," by C. O. BURGE, F. T. G. WALTON and G. E. W. CRUTTWELL; "Concrete Quarters," by THOMAS KER; "Barry Dock Work," by JOHN ROBINSON; "The Reclamation of Lake Aboukir," by H. G. SHEPPARD.

TRADE PUBLICATIONS.

—*Water-Works Supplies.* Walter S. Payne & Co., Fostoria, O.—This catalogue describes five styles of tapping machines for tapping water or gas mains under pressure and the corporation cocks, curb cocks, etc., manufactured by the firm.

—*Facts and Suggestions* Relating to Municipal Public Works, by Rosewater & Chrysler, Omaha, Neb.—A neatly printed little pamphlet which discusses sewerage, paving and street grades, intended to impress upon city officials that for the proper design of these municipal necessities the services of a competent engineer are indispensable.

—*Kalamazoo Railroad Velocipede & Car Co.*, Kalamazoo, Mich.—Catalogues of velocipedes, inspection cars, section cars, etc. The wheel used on these cars is a combination wood and steel wheel which is guaranteed to withstand the severest climatic changes.

SOCIETY PROCEEDINGS.

Engineers' Club of Cincinnati.—At the last regular meeting, seventeen members present, it was decided not to adjourn during the months of July and August. The paper for the evening was by Mr. ERNST LIETZE, on "Distribution of Power from a Central Station," in which he gave an exhaustive résumé of the various methods of transmitting power for mechanical purposes and a comparison of the results derived from each. He also presented numerous formulæ, calculations and tables deduced from them showing the specific duties, efficiencies, etc., for the various systems. The second part of the paper comprised a detailed description of the pneumatic power supply of Paris, France.

ENGINEERING NEWS
AND
AMERICAN RAILWAY JOURNAL.

Published Weekly at Tribune Building, New York.

Vol. XXIV. Saturday, July 26, 1890.

D. McN. STAUFFER, A. M. WELLINGTON.....EDITORS

CHAS. W. BAKER, E. E. R. TRATMAN, M. N. BAKER, F. P. BURT, } ASSOCIATE EDITORS

GEO. H. FROST.....BUSINESS MANAGER

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COMING TECHNICAL MEETINGS.

Association of Civil Engineers, Dallas, Tex.—Next meeting, Aug. 1, Secy., E. K. Smoot, Elm and Austin Sts.

Engineers' Club of Philadelphia, Pa.—Next meeting, Aug. 9. Secy., Howard Murphy, 1122 Girard St.

Engineers' Club of Kansas City, Mo.—Next meeting Aug. 4. Secy., Kenneth Allen, 900 Baird Building.

Western Society of Engineers, Chicago, Ill.—Next meeting, Aug. 5. Secy., J. W. Weston, 230 La Salle St.

American Society of Civil Engineers, New York.—Next meeting, Aug. 6. Secy., John Bogart, 127 E. 23d St.

Engineers' Club of St. Louis, Mo.—Next meeting, Aug. 6. Secy., W. H. Bryan, 30 South 7th St.

Civil Engineers' Club, Cleveland, O.—Next meeting, Aug. 12. Secy., C. O. Palmer, 22 Cedar Ave.

Civil Engineers' Association of Kansas, Wichita Kan.—Next meeting, Aug. 13. Secy., J. C. Herring, Wichita.

Engineering Association of the Southwest, Nashville, Tenn.—Next meeting, Aug. 14. Secy., Olin H. Landreth, Vanderbilt University.

Engineers' Society of Western Pennsylvania.—Next meeting, Aug. 19. Secy., S. M. Wickersham, Pittsburg, Pa.

Engineers' Club of Cincinnati, O.—Next meeting, Aug. 19. Secy., J. F. Wilson.

New York Railway Club.—Next meeting, Aug. 21. Rooms, 113 Liberty St.

American Society of Railway Superintendents, Boston, Mass.—Annual meeting at New York on the day preceding the fall meeting of the General Time Convention. Secy., C. A. Hammond, 350 Atlantic Ave.

WE wish to stir up the journalistic consciences of a few of our contemporaries on the subject of kleptomania. We do not call it stealing, since we cannot conceive that the editors of journals of any reputation whatever for honesty would copy matter or reproduce illustrations from contemporary journals without giving proper credit, unless the said editors had in some unmentioned way become victims to the disease known as kleptomania.

Of the erring ones which we now propose to arraign the *Street Railway Journal* seems the worst sinner, since in its issue for May it reproduces direct two cuts from the inset in our issue of February 22 on the Chicago Cable Railway Tunnel, and avows with angelic innocence that the cuts are "reproduced from sketches kindly furnished our representative by the former chief engineer of the companies." To further complicate and make more atrocious its assault upon our property rights, it has stamped upon the cuts, "Street Railway Journal, N. Y. Eng."

Against the next one to appear at the bar, London *Engineering*, we have only circumstantial evidence to offer, but it is evidence quite sufficient for conviction in our own minds. In its issue of July 11 it publishes an account of "the Compressed Air Hospital at the Hudson Tunnel" which has all the earmarks of having been "cribbed" from our issue of June 14, although we cannot, of course, prove that it may not have received the information from some other source. Another article in its issue of the previous week, describing submarine pipe-laying at Rouse's Point, N. Y., we are morally sure was taken from our issue of May 3.

As for the last two to come up for trial, they have offended against the spirit of the law rather than its letter. Their names are the *Railway Age* and the *Railway Review*, of Chicago. When our statistics concerning steam car heating were published last month, both these papers, as was their perfect right, refrained from making the slightest allusion to them in any way. Recently the New York *Press* republished some of our figures, slightly altering them for some inscrutable reason, and stating merely that they were "statistics gathered by railroad experts." We are personally informed by the writer of the article in the *Press*, however, that this was a sin through ignorance. The figures were altered by another hand and were given to the *Press* without notice that they had been published before.

Even as altered, however, the statements bore plain evidence of having been taken from our columns, and our Chicago contemporaries above named were without excuse, therefore, in copying them from the *Press* and giving us no credit, unless, indeed, they raise the plea of ignorance as to what is going on in the railway world.

Now for the penalties to be inflicted upon these various criminals. We have heaped coals of fire on the *Street Railway Journal* by taking an interesting cut from its columns, for which we give it due credit elsewhere in this issue. *Engineering* has enough to bear in its chagrin because its too hasty diagnosis of the *City of Paris* disaster has been proved to be a long way off from the right one. The *Age* and *Review*, who have carefully kept the letter of the law, shall be let off with some advice. It is best to go to headquarters for statistics, and not rely on daily papers; so if they want to copy from this journal, and do not dare to give us credit for it, they had better bravely "hook" it outright and trust that their readers will never find it out.

THE proposed Diamond Shoals lighthouse, of which we give illustrations this week, is likely to be the precedent for a long line of similar structures in less prominent but analogous locations if it is successfully constructed, and we doubt not it will be, by any one of the three bidders whose plans we illustrate in this issue. Not on the whole globe, however, can be found a place where a lighthouse is more needed. Hemmed in by a projecting cape on the one side and the Gulf Stream on the other, a narrow belt of water only is open to the choice of south-bound vessels, and nearly half of this space is occupied by shifting beds of quicksand shoals which perpetuate themselves as a whole by the currents, but shift about in detail in quite lawless fashion. Nothing except some permanent building reaching far down into the sands can be placed there with any hope of success. A whistling buoy was placed there and never heard of more. A lighted buoy was tried, but wrecked by the waves and swallowed up in the quicksand. A lightship has been often asked for, and would long ago have been placed there, except that it is quite sure it could not be anchored so as to withstand the terrific seas over the shoals. A skeleton or screw pile lighthouse would be as sure to come to grief.

Only in recent years has it become possible to erect a masonry or concrete lighthouse in such spots, and such a lighthouse is the only thing which has any chance of serving the purpose and surviving. It is not yet proven that even this can be constructed or survive, but with such bids as have been put in it is pretty sure that it can be constructed; while it seems almost certain that it will survive if built, let the waves beat never so hard and cut away the sand never so deep. The work is one whose progress will be watched with great interest by all engineers. We regret not to have been able to present with the other three designs that prepared by Mr. GUSTAV LINDENTHAL, which was for a much more massive structure than that proposed, and was estimated to cost nearly four times as much. Until the contrary is proven, however, the general impression will be that the lighter structures will stand until the waves wear them out.

THE question of whether Congress has the right to grant powers of condemnation for a bridge across the Hudson has been made the subject of considerable discussion in the daily press, and some doubts have been expressed in regard to it; as also in committee while the bill was pending. But it appears from high legal opinions that as a matter of fact the sovereignty of Congress over all property within the United States for the purpose of carrying out the powers delegated to it, such as regulating interstate commerce, maintaining post roads, providing for war, etc., etc., has been maintained by an unbroken line of old and recent decisions of the Supreme Court, so that the power is beyond all dispute, and hence there is as full authority to proceed with construction under the Lindenthal bill, which has never even been presented to the legislatures of New York and New Jersey, and is never intended to be, as if it had also the legislative sanction from both of those States, which the Greene bill has obtained. On the other hand, the latter bill, while having full authority from both the States concerned, lacks the needful authority from Congress, nor is it now ever likely to obtain it until the Lindenthal interest has had a fair chance to carry out its project, *and* the real interest behind the Greene bill and the exact plans for their proposed structure have been made known.

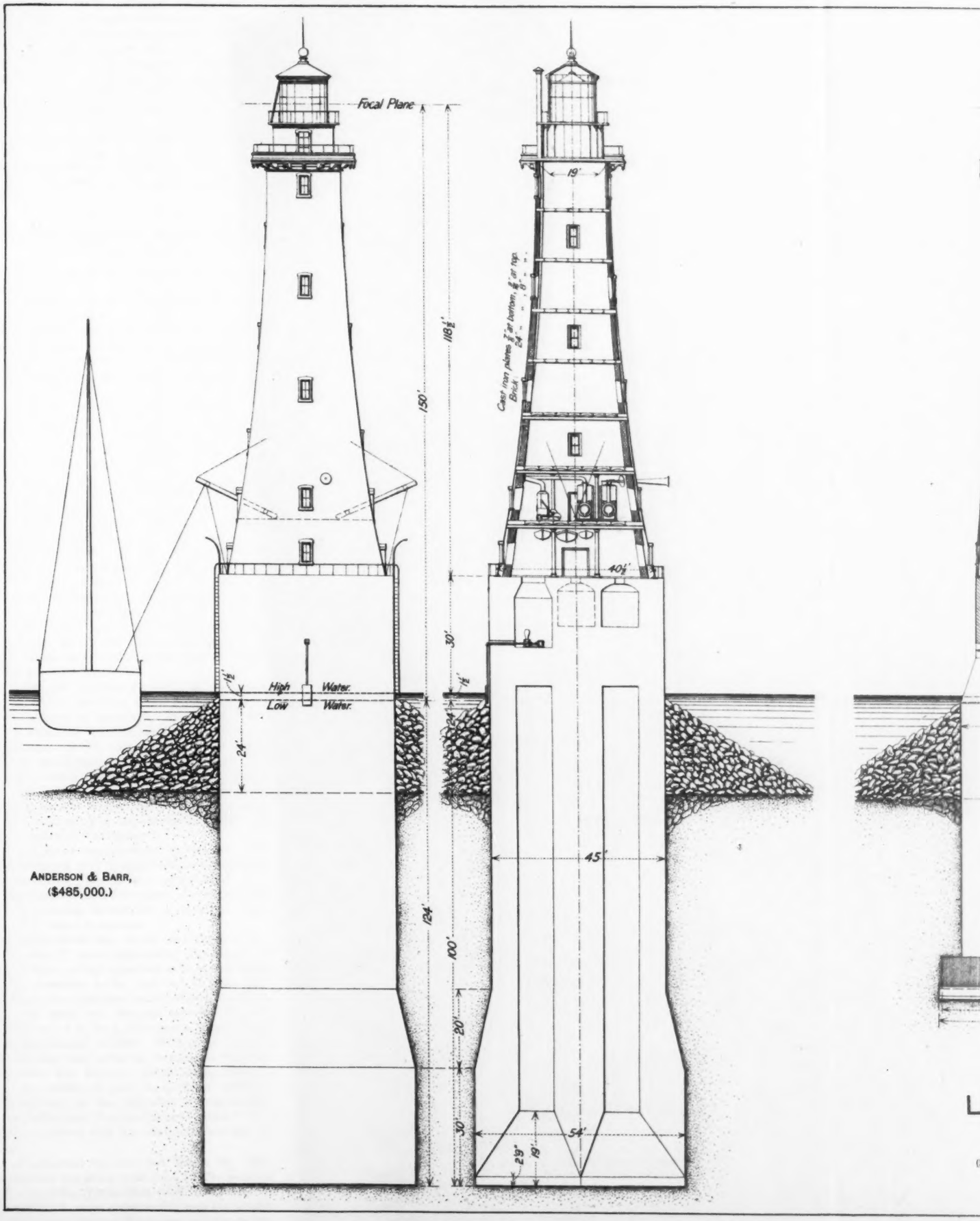
NEW JERSEY has a law now in force, and has had since 1886, providing in express terms:

> That no bridge, viaduct, or fixed structure shall be created by any person or corporation, over or in any part of the navigable waters separating this State from other States, where the tide ebbs and flows, without express permission of the legislature of this State given by statute for that purpose.

But this decision was set aside in the most emphatic terms by Justice BRADLEY, in which he says:

> We think that the power of Congress is supreme over the whole subject (interstate commerce) unimpeded and unembarrassed by State laws or State liens; that in this matter the country is one, and the work to be accomplished is national, and that State interests, State jealousies, and State prejudices are not required to be consulted. In matters of foreign and interstate commerce there are no States.

A long line of similar decisions are quoted in this decision and others like it, starting from the times of Chief Justice MARSHALL, who decided that in all matters relating to the war, postal and commercial powers delegated to Congress, it was invested with all the fullness of sovereignty, regardless of the States, and was its own judge as to the means to be chosen for exercising these powers;



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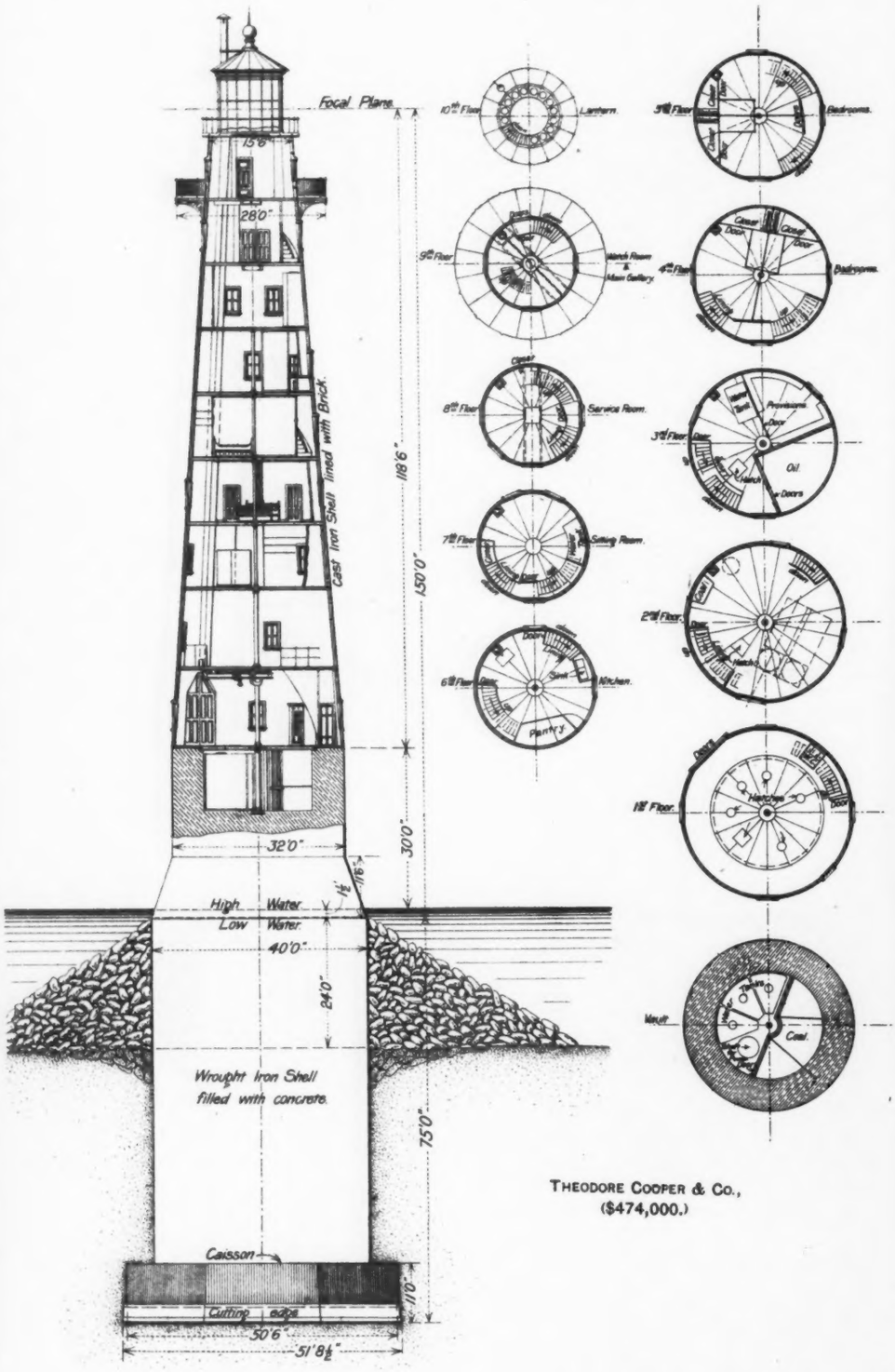

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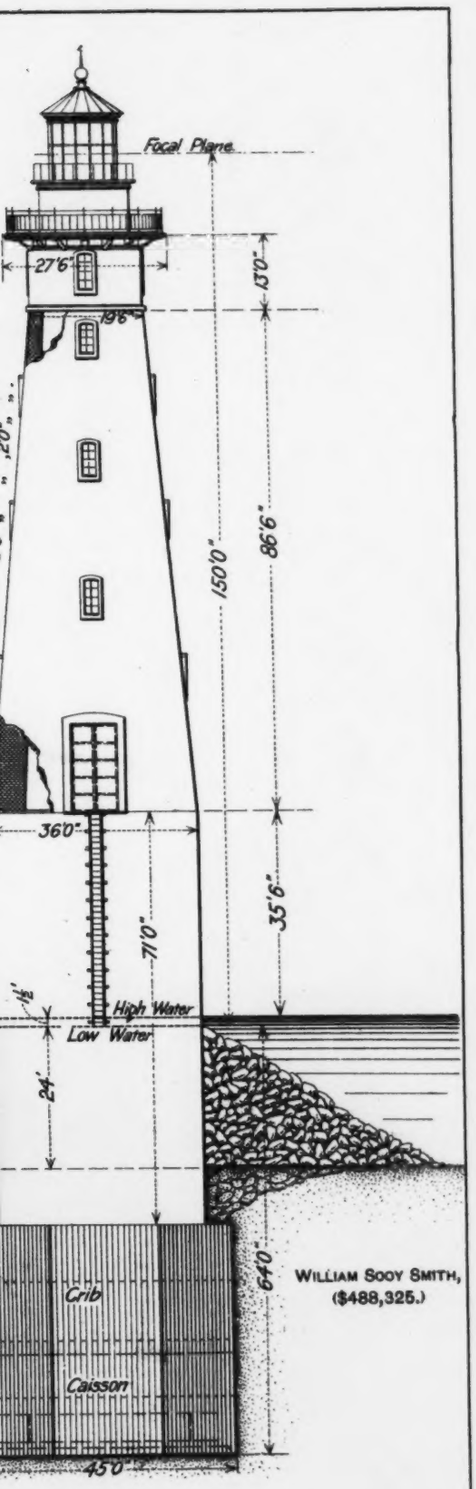

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that it could, therefore, build itself or authorize others to build roads, railways, buildings, forts, canals, bridges, etc., and could condemn any property needed to this end with or without the consent of the States, subject only to the constitutional provision that private property shall not be taken for public use without just compensation. There is also a surprising number of cases in which Congress has actually exercised these powers, and it is well that there has been. It would be intolerable that a work of national importance, like the Hudson River Bridge, should be impeded until the petty jealousies of a State like New Jersey could be conquered and the greed of the lobby satisfied.

The Local Engineering Societies on the "Affiliation" Question.

We present in another column a letter from Mr. ALFRED P. BOLLER, in regard to the organization of the American Society of Civil Engineers, which we will not attempt to summarize fully (every member should read it for himself) but in which he says in substance that there is a general feeling that the Society should so reorganize itself that there should be an appropriate grade within it for engineers in good standing of all grades of experience who desire a connection with it; that the Society should recognize and facilitate the formation of chapters for local meetings of its members; that it should do the equitable thing in respect to aiding local societies to reorganize as chapters of the Am. Soc. C. E., by affording all those who are not already connected with it an opportunity to join with somewhat less formality than usual, and perhaps with some financial recognition of past dues paid to the local society, and that beyond this the Society should let the "affiliation" question alone, it being quite certain that the bone and sinew of most of these local organizations is already connected with the national Society also, and hence may well be left to take the necessary steps to convert the local association into an integral part of the national Society if it be really for the best interests of its members that it should become a part of it.

Mr. BOLLER surmises correctly, as we believe, that in these views he voices the feeling of the great majority of members. The feeling is now all but universal that some radical changes in the organization of the national Society are needed, and this among them; and as one evidence of this feeling a Committee on Revision of the Constitution has existed for over a year, and has so far given up most of its time and all of its reports (beyond a codification of the old constitution) to this very question of "affiliation."

Its last report was submitted at Cresson, and is upon its face a very disappointing and discouraging document. We do not regard it as such. Properly interpreted, it is rather a warning to the Society to change its methods of seeking "affiliation" if it wishes to succeed.

It appears from this report that there are now no less than 27 local engineering societies in the United States, which appeared to be of sufficiently similar character to the Am. Soc. C. E. to make it seem to the committee worth while to submit to them by letter five different schemes for such "affiliation," *i. e.*, for a more or less organic union with the national Society. With these different schemes was also given an intimation that "the committee was anxious, before taking action, to have the benefit of your co-operation, with any plan that may, in the judgment of your society, be best calculated to attain the end desired." Personal conference with the committee was also invited.

This invitation was sent out March 26. Time for response was given until June 4. *Ten* societies only, out of the 27 consulted, took the trouble to respond at all; *seven* societies only took the trouble to express any views on the subject whatever; *two* of the societies only took the trouble to send any personal representatives to the proposed meeting, and *none* of the societies took the trouble to send any representatives authorized to express any views or take any part in the discussion. What is the natural inference? Is it that the members of these local societies take no interest in the question submitted, and prefer that the local organizations should forever remain entirely independent? We do not think so, as we have just stated.

The seven societies which respond, in fact, agree in expressing a wish that some kind of "more perfect union" might be effected, although they differ as to what kind, and show every disposition to co-operate in any rational plan. The real feeling, if we mistake not, which underlies all these responses is that the Am. Soc. C. E. as now organized, neither invites nor permits of a connection of any kind with any local societies; that if it desires any such connection, or desires to itself serve as a substitute to these local organizations, it is at full liberty to reorganize itself so as to invite or permit this; that when it has done this outsiders will then be able to form some intelligent idea as to whether they desire any closer relations with it or not, and that in the meantime they do not propose to bother their heads about the organization of a society over which they have no control and with which they have no relations, nor to answer any questions as to what they might and might not do under conditions which do not exist. In other words, their attitude is very much like that of the "pretty maid" in the jingle:

> "What is your fortune, my pretty maid?"
> "My face is my fortune, kind sir," she said.
> "Then I'll not marry you, my pretty maid."
> "Nobody asked you, kind sir, she said.

Not thus are maidens won, nor small and weak societies persuaded to allow a would-be great and powerful one to swallow them alive. The response to the *de haut en bas* attitude which most of the local organizations believe that the American Society holds toward them is plainly visible in the seven "Nobody-asked-you-kind-sirs," which the sorrowful committee is compelled to admit are the only result of their labors so far. We fear it will be the only result of all such labors to the end of time.

To see in a few words why this is so, let us drop for a moment into parable: Suppose that a man were seeking to find favor in the eyes of a number of young women, and were to send circulars round about amongst them, saying in substance: "What can I do to make myself agreeable to you? You must see that it is the order of nature that I should find favor with one or more of you. You must see that I am the most desirable person for you to 'affiliate' yourself with anywhere about these parts. Now, I am willing to do anything that will be most agreeable to you (if you do not ask too much). To help you to understand the whole matter, here are five different plans which kind friends have suggested for me to act upon. Which do you think will make me most agreeable?"

The probable answer to such a proposal would be—silence for the most part, and civil contempt from the remainder. And this is precisely what the committee have received, in one instance at least; for it is very strange that "Plan E suggestion of one of the local associations" (page 7 of their report), is written throughout in a vein of bitter and contemptuous sarcasm, thinly yet skillfully concealed, so that it should seem only be a sudden breaking out in the West of the supposed views of the "New York men," and so be swallowed whole. We chance to know that it was so written, and it is apparent that it was so swallowed. If re-read with this idea in mind, however, the vein of sarcasm hidden in every line will be apparent.

But if there chanced to be some good-natured one among the damsels just referred to, and she chose to be so frank as to answer truly, the chances are that she would say something like this: "You foolish man, the way for you to make yourself agreeable is to *be* agreeable. You are not agreeable now, and that is all we care to know about you at present. Neither do we care much whether you ever are. If you never are, we shall manage to survive; if you ever are, the change must come from within and not from without; from your own good sense, and not from the advice of those whom you wish to please."

This we believe to be precisely the attitude of the local organizations; and it is an eminently wise and proper one. Moreover, the American Society is putting itself in an improper and ridiculous attitude by sending around circulars to outsiders of any kind, organized or unorganized, asking them what it can do to make itself acceptable to them. The one fact which it should be able to see without asking any questions is, that it is not acceptable to a great many outsiders. It is *its own* business to find out what the trouble is, and do what it can to remedy it, consistently with due respect to its objects and character. If, then, the effect is to bring in a large accession of members, well and good. If not, well and good again, unless further reflection shows that there are still imperfections which may be corrected. He is no true friend to the Society who sets before himself as an end the bringing in of more members by swallowing outside societies in whole or in part. The true question which the Society should ask itself, and the only one, is: Are we driving away members by any correctible defects of our organization, and compelling them to connect themselves with other bodies instead of this? If the answer is Yes, changes should be made at once, whether asked for or not. Surely the Society knows its own business best, and is as competent to judge of this as outsiders can be for it. If the answer is No, or when it is, then the Society has done enough, and should be able, "having done all, to stand." It does not necessarily follow because there is not an immediate rush of new members that a policy is wrong. Time is an important element in such matters. Great bodies move slowly. A policy which seeks *immediate* affiliation or none is from every point of view a bad one.

For example, if the members ask themselves in good faith the question, Is there an appropriate and acceptable grade within the Society for every engineer of good standing? they must see at once that there is not. There is the grade of Member, for which a pretty high grade of experience and capacity is required, which it is generally felt should be higher yet; but below this there is only the grade of Junior, for which pretty high dues and a very low grade of experience is required. Multitudes of men, a clear majority of all those practicing engineering at any one time, have not had quite experience enough to entitle them to become Members, yet have had far too much experience to be willing to be dubbed Juniors and come in among the boys. By slightly lowering the qualifications for a Junior, and materially lowering its dues, and, on the other hand, by a considerable increase in the qualifications for Member, which is almost universally desired, room is made for an intermediate grade of Associate Member, corresponding to that which in the Institution of Civil Engineers is the largest grade of all, as it naturally should be in any such society.

The present grade of Associate already provides a place for manufacturers, mathematicians, chemists, or any other "one who from his scientific acquirements or practical experience has attained eminence in his special pursuit, qualifying himself to co-operate with engineers in the advancement of professional knowledge." With this change made, therefore, there would be an appropriate place within the Society for *every* person who is now connected with a local society, so that, if they continued to remain connected with local societies only, it would be evident that it was by their own free choice. But until then, what is the use of talking about "affiliating" or dispensing with the independent local societies, when a full half of

their members cannot enter the Am. Soc. C. E. as full members, and will not consent to be admitted as Juniors?

Similarly, if the Society asks itself what other reason there is why the local societies are now independent instead of "affiliated," they will discover one at once in the fact that the present constitution does not permit nor encourage the formation of local sub-organizations of its own members. If local organizations are formed they must be independent. To see that this is unwise it is not necessary to assume that the local organizations are independent only because of this, or would not wish to continue so after a free choice was open to them. Let them first have a free choice given them, and if after that they still show a disposition to remain permanently independent it will be time to conclude that they really prefer to be independent or seek some further remedy. At present it is unwise and superfluous to do so.

Looking a little further, a third obstacle to organic union will be found in the fact that the present constitution throws an entirely disproportionate amount of passes into the hands of the members residing in and about New York; and looking a little further yet, a fourth obstacle will be found in the fact that the local meetings of the New York members are treated as something other and higher than local meetings in any other city could be; *i. e.*, they are called meetings "of the Society," which they are not.

Here are four separate obstacles of an evident character, which are compelling the formation of local engineering organizations independent of, and in a measure antagonistic to, the American Society. We are firm in the belief that they are the only obstacles; the only reason why independent local organizations exist. But for them, we fully believe that all new organizations would be found as local sections or chapters of the American Society of Civil Engineers, and that all the older organizations would *gradually* become such, for the sake of the greatest good of the greatest number. To expect that even a majority of them would instantly become such is not to be expected of this or any other policy which is really wise and conservative.

The Society would be acquitting itself more creditably if it should recognize the fact that so long as it does not show sense enough to see and correct these defects without asking advice from outsiders, it is not likely to find favor in their eyes, nor be much aided by them in persuading the organizations with which they are now connected to become swallowed up in one with which they are not connected, and which they are beginning to look on with some contempt as a senseless and moribund institution. The undignified negotiations which have been lately in progress are well calculated to perpetuate this feeling and should cease. If the Society has not interest enough in its own prosperity to determine what is its proper form of organization, and to put it in force, it had better quietly die and give place to a better one. So far no effort of the kind has been made. The Society has not been asked what it wishes and will consent to. All the consultation has been with outsiders who care nothing about it. It is not surprising that the responses are few and more or less contemptuous.

Interlocking and Block Signaling in Great Britain.

The Board of Trade returns showing the progress in interlocking and in the use of the block system on British railways to Dec. 31, 1889, has just been received. The following table shows the present status of interlocking.

Of the total of 39,397 signal and switch levers in the United Kingdom, 35,845, or 91 per cent. were interlocked at the close of 1889. This is an increase of 1 per cent. over the previous year, when the returns showed the interlocked switches to be 90 per cent. of the whole.

	Number of cases in which any passenger line is connected with or crossed on the level by:				Number of cases in which the usual requirements of the inspecting officers of the Board of Trade have or have not been complied with in the following respects:					
	Any other passenger line.	Any goods line.	Any siding.	Any cross-over road.	Concentration of signal and point levers.		Interlocking of signal and point levers.		Addition of safety points in case of goods lines and sidings.	
					Have.	Have not.	Have.	Have not.	Have.	Have not.
England and Wales	4,478	1,522	18,547	7,240	29,817	1,970	30,016	1,771	18,833	1,236
Scotland	803	243	3,266	1,123	4,433	902	4,519	916	3,044	465
Ireland	440	100	1,347	288	1,258	917	1,310	865	823	624
Total Unit. K'gdom	5,721	1,865	23,160	8,651	35,508	3,789	35,845	3,552	22,700	2,325

In this country we suppose ourselves to be advancing quite rapidly in interlocking, inasmuch as for the past few years we have equipped the yards at many of our important railway centers on the richest roads with interlocking plant.

In the face of the above remarkable showing, however, our use of the interlocking system seems insignificant. When we have 9 out of every 10 signals, switches, and railway and highway grade crossings protected by good apparatus constructed on the interlocking principle, then we can stand some comparison with England in this matter.

A good illustration of the fact that protection is needed at switches as well as at crossings is the fatal collision at Genesee Junction, described last week as occurring at a grade crossing. It proves that the crossing was properly protected and was safely passed by the West Shore train. The collision with the Western New York & Pennsylvania engine occurred a few hundred feet beyond the crossing, where a Y from the W. N. Y. & Pa. tracks joined the line of the West Shore.

There is a general impression that there are very few highway grade crossings in England. The above report shows that there are not less than 8,651 in the United Kingdom, or about one to every two miles of road. Comparing this with Massachusetts, which perhaps approximates as much to English conditions as any State in the Union, we find that Massachusetts has 2,218 highway grade crossings, or one to every 1 1-3 miles of road. Almost certainly this is a much higher proportion of crossings than the average of the United States, for Massachusetts as a whole is one of the most thickly populated States. Probably, however, the English statistics include all private crossings, and these must make up a large proportion of the total; yet even with these it would seem that the disparity between England and the United States in the number of grade crossings per mile is not so large as is generally supposed.

The greater portion of the report, however, is taken up with the returns regarding the system of train operation in use. As is well known, these complete returns are obliged by law to be regularly made to the Board of Trade. Their effect in forwarding the introduction of the block system has certainly been very great. The following is the summary for the United Kingdom:

Total mileage of railways (double track, 10,705; single, 8,238)	18,943
Double track worked by absolute block	10,116
Single " " " "	506
" " " " and train staff	3,859
Single track worked by absolute block and train tablet	520
Total worked by absolute block	15,091
Single track worked by permissive block	74
Double track worked by telegraph (not on block system)	141
Single track worked by telegraph and train staff	114
" " " by system in which only a single engine, or two engines or more coupled are allowed on the track at one time	214
Single track worked by train staff system alone	1,431

From the above table it appears that more than three-fourths of the mileage of the United Kingdom, and of course a much greater proportion of the traffic, is worked on the absolute block system. Of the remaining lines, all but 500 miles are worked by the train staff system.

Let us suppose for the sake of simplicity that the only benefit gained by the English system of train operation over our own antiquated one is in the matter of collisions. In England, during the year 1889 there occurred 106 collisions. Excluding the great Armagh disaster, these accidents resulted in 11 deaths and 409 injuries.

We exclude the Armagh disaster because it was of such magnitude that to include it in any single year would make the record manifestly incorrect when our object is to obtain the average annual casualty. Another reason is that we are now considering methods of train operation, and the Armagh disaster was due to the faulty brake system. Also the block system was not in use on that road; if it had been, the fatalities would have been comparatively slight.

According to the Interstate Commerce Commissions' statistics, as given in our issue of June 7, the collisions in the United States in the year ending June 30, 1889, resulted in the death of 311 persons and the injury of 1,314. It is pretty certain, however, that these figures are too small, the compiler having erred in classing many fatalities under "other train accidents" which should have been classed under collisions. The total from accidents to trains, as given by the Commission, however, is 1,230 killed and 4,204 injured. From other statistics we know that the proportion of deaths and injuries resulting from collisions to the whole number due to train accidents is about 47 per cent. of deaths and 44 per cent. of injuries. We may therefore take 578 deaths and 1,850 injuries as the present total result of collisions in the United States; whereas, as stated above, the United Kingdom has but 11 deaths and 409 injuries.

As stated in our issue of June 7, 1890, in many respects the United States compares remarkably well with Great Britain in this matter of safety in railway travel. We are far ahead of the mother country in brake practice, for instance. But as regards the mode of train operation, judging each system only by its fruits, we are far in the rear.

Let us make another comparison, and include the Armagh disaster to avoid any possible objection of unfairness. Including this, the deaths and injuries due to train collisions in the United Kingdom during the past four years have been as follows:

Year.	Total collisions.	Deaths resulting.	Injuries resulting.
1886	118	5	515
1887	80	28	552
1888	101	12	524
1889	106	89	669
Average	103	33	557

In our issue of June 7 we estimated the annual train mileage of the United Kingdom at 285,000,000 miles, and of the United States at 732,000,000 miles. On this basis then, to make as good a record as the above, we should have yearly 265 collisions, killing 85 and injuring 1,432.

The Interstate Commerce Commission's figures quoted above give no hint of the number of collisions, and refer only to a single year. The only other statistics available, those of the *Railroad Gazette*, show as follows:

Year.	Total collisions.	Deaths resulting.	Injuries resulting.
1889	749	245	777
Av. for 4 years	689	255	778

The *Gazette's* record is gleaned from newspaper

reports, and so lays no claim to completeness, especially as regards the number of accidents and the number of injuries. As stated above, the correct number of deaths and injuries from collisions in 1889, as near as can be determined, was 578 deaths and 1,850 injuries. Now, if we may assume that the *Gazette's* list for four years bears the same proportion to the total that its list for 1889 does to the total for that year, we shall have 618 deaths and 1,852 injuries as the total average result of railway collisions in the United States during the past four years.

The contrast then is as follows:

		Resulting from collisions.	
	Collisions.	Deaths.	Injuries.
Est. ave. for four years in U. S.		618	1,852
Ave. for 4 y'rs to make record as good as Great Britain's	265	85	1,432
Ratio.....		1 to 7.3	1 to 1.3

Our apparently good record in the matter of injuries is, of course, due to the different basis on which the records are made up, the British records including trivial collisions and injuries which are omitted here. In the matter of deaths, however, no such discrepancy can arise, provided all the deaths are reported. We are much inclined to believe that even the above estimate is too small for the total annual fatalities in the United States; but at any rate it can hardly be too large, and it follows, therefore, that the American system of train operation is at least *seven times* as fruitful of deaths from collisions as the English, and probably even more fruitful of collisions not resulting in death.

Returning now to the statistics as to the use of the block system, it is much to the credit of our British cousins that they are not satisfied with the remarkable excellence already secured. The Armagh collision called attention to the fatal disasters at any time possible on roads not fitted with automatic brakes and the block system, and the Board of Trade issued an order making the use of both these compulsory. The next year's returns will doubtless show a marked effect from this order.

In conclusion, it is only fair to point out that America's backwardness in the use of the block system and of interlocking is by no means due to a lack of ingenuity and merit on the part of her inventors and engineers. As shown in our issues of Dec. 21 and 28, 1889, in simplicity and effectiveness, American interlocking apparatus now ranks far ahead of the English. In block signalling, too, it seems likely that the system of the future on this side of the water will be an automatic one, dispensing with the risk and expense necessary where signalmen are the sole reliance. But, as our accident record eloquently proves, the adoption of the block system in some form cannot be much longer delayed. To do so is to waste property and destroy many lives and limbs which would be saved by the adoption of a proper system.

CORRESPONDENCE.

A Peculiar Wooden Bridge Failure.

SOLON, Me., July 19, 1890.

TO THE EDITOR OF ENGINEERING NEWS:

SIR: A rather peculiar accident occurred to the wooden railway bridge across the Canabasset at North Anson, Me., during the tornado of last week. This, a through covered bridge, is of the Towne lattice type, with a plank arch in each truss between the two sets of lattice, is in three spans, two of 133 ft. each, and the third of about 85 ft., and was built two or three years ago.

The lateral bracing, both below and overhead, is an ordinary Howe truss system, but the ends of the struts are cut on a bevel instead of square, and rest against iron plates, *a few of which had slipped out some time ago*. There are a few braces connecting the roof chord and the side trusses, placed at angle of but little over 30° to the vertical.

After the storm the ends of each span were in place, but their centers had been sprung about 18 ins. out of line, so that the track formed a series of reverse curves, while the top of the bridge, roof and all, was tipped so that the trusses were at least 4 ft. out of plumb. The braces mentioned above were mostly knocked out. These trusses were apparently uninjured and were brought back into shape, so that trains were running the second day after the storm.

S. E. THOMPSON.

The Use of Charcoal in Water-Works Filters.

NEW YORK, July 19, 1890.

TO THE EDITOR OF ENGINEERING NEWS:

SIR: We note in to-day's issue your article on "Filtering Plants of American Water-Works." Your table "F" does not give all the water-works using our filters. For example, water-works of the Pacific Coast you credit us with none, whereas, Porterville, Cal., has been using our system for some months in connection with their water-works. Exeter, N. H., adopted our system in August, 1887, and gave us a second order in Dec., 1887, so that your statement that New England has but one commercial or mechanical filter, a Hyatt, is misleading.

We also notice that you consider filters making use of charcoal and coke, as vastly superior to those using gravel, sand, etc. Our filters are equally adapted to either material, but the objection to charcoal and coke, is, that they absorb and retain the impurities in the water, which cannot be dislodged when the filters are cleaned and, therefore, such materials as charcoal and coke become dangerous filtering mediums when there are any disease germs in the water. The contrary is the case with sand and gravel, as they cannot absorb and retain impurities and are thoroughly cleansed when the filters are washed. The drawback to the use of charcoal, which is admitted to be the best filtering medium, is the fact that it cannot readily be cleaned and, therefore, has to be thrown out or re-burnt, otherwise its continuous use is dangerous. It is, therefore, too costly a medium to be used on a large scale.

National Water Purifying Co.,
JNO. C. SYMONS, Sec'y.

NEW YORK, July 22, 1890.

TO THE EDITOR OF ENGINEERING NEWS:

SIR: We are much interested in reading the editorial on "The Filtering Plants of American Water-Works," and pleased to note that mechanical or "machine' filtration occupies a prominent place in the article.

We must take exception, however, to the statements and conclusions in reference to the use of charcoal as a filtering material. It is true that charcoal will remove organic matter in solution, gases, etc., but only to a limited extent and not when used in water-works filters as there is no practicable way to cleanse the material. Therefore, the statement is misleading, and the readers of your valuable paper might follow the suggestions given and the results would certainly be contrary to their expectation. Dr. FRANKLAND'S experiments proved that charcoal is temporarily effectual; but for want of cleansing, it soon becomes useless or even worse than useless, as the number of organisms in the water that had been filtered through charcoal was greater than in unfiltered water.

We send herewith list of cities where our plants are in operation, by which you will see that the total number of city water-works now using our system is 34. Beside these we are now building plants for Beaver Falls, Pa., St. Thomas, Ont., and Murphysboro, Ill.

Hyatt Pure Water Co.,
F. V. M. HUDSON, Vice-President.

[Our statements as to the use of charcoal in filters were made perhaps without sufficient information as to the latest scientific opinion on the subject. But if it be indeed true, as our correspondents state, that charcoal in a filter is worse than useless, the fact is one which ought to be much more widely known, in view of our showing of last week, that about one-third of the water-works filters of the country make use of charcoal.

Our columns are open to the discussion of the question and we shall be pleased to give space to any communications from those using charcoal filters for large volumes of water concerning their success in removing bacteria, the character of the water purified, and the length of time during which the charcoal continues effective.

The facts are that on this one point of the removal of bacteria from the water, the future of filtration must largely turn. It is comparatively easy to extract the silt and clay, especially if a precipitant be used; but these are of little importance so far as the effect on health is concerned compared with the microscopic living organisms which may exist in great numbers in water that appears perfectly pure to the eye. Fresh charcoal will remove these, but how long will it remain fresh, and is any practicable means in use for cleansing it when it becomes charged with organic matter? The mechanical filters are claimed to remove these organisms, partially by the coagulant used and partly by a process of aeration before passing the water through the filters. The matter is certainly of great importance, and we shall be glad to give space for communications from those who have had experience with this method, as well as the others above referred to.

Readers interested in this subject will find a valuable paper by Mr. J. J. R. CROES in ENGINEERING NEWS of June 16, 1883, describing the principal filters in the United States, which brings out very clearly the fact that water-works filters other than the mechanical type have very frequently proved failures.—ED. ENG. NEWS.]

The Organization of the American Society of Civil Engineers.

NEW YORK, July 16, 1890.

TO THE EDITOR OF ENGINEERING NEWS:

SIR: The discussions during the past few years regarding a substantial reorganization of the American Society of Civil Engineers must by this time have convinced even the old-time conservatives of the society that the machinery of its methods should be broadened if its national character is to be maintained. There are powerful centers of engineering in all the large cities of the country that should all be unified under cover of the great National Society, but this cannot be done under the organic law of that society as it now stands. Familiarity with the development of the American society from its early days, and with the growth of engineering centers, has impressed me with the fact that the next step for the society to take is in the direction of the creation of local chapters, under charters granted by the parent stem; a conviction, I think, pretty generally entertained now by its members. The great difficulty in accomplishing that result lies in the maintenance of a high standard of membership qualification, in which respect this society holds a unique position among American societies. I believe the comparatively recent Society of Mechanical Engineers is the only other scientific organization that requires anything more than respectability and willingness to pay annual dues as a qualification for membership. That difficulty, however, is one that can be gotten over by a little heroic treatment, performed by the members themselves, who, it is assumed, are of one accord in protecting that essential feature so jealously guarded all these years.

Almost all of the local engineering societies or clubs derive what standing they have as engineers' associations from those members who belong to the American society, without whom the local society could not live. Let these men, then, say to their associates: "We are desirous of establishing a local chapter of the American Society of Civil Engineers, and would like to arrange to have this club as at present organized be the nucleus of it. But in order to do so the roll of membership must be submitted to the society's standard and grading, and our present membership divided into full members, associates, juniors, or fellows. We ask you to agree to such classification; otherwise we will resign in a body and establish an independent club, which will be the "——— Chapter of the American Society of Civil Engineers." It seems to me this is the commonsense treatment of the difficulty, and one that should commend itself to any ordinary intelligence.

Under the chapter system the New York members should be organized like these in other cities as a New York chapter, the parent society holding its two great meetings a year, as now, and attending to the editing and publishing of all papers, which would place the "Transactions of the American Society of Civil Engineers" easily first among the publications of like character in the world. With an able secretary, well paid for devoting his whole time to society affairs, and with a liberal charter system, the influence of the American Society would ramify throughout the whole country and command a consideration now accorded to it only in a very limited degree. This society will never completely fulfill its mission until the time comes when membership in it will be a necessary passport for successfully practicing the profession of the civil engineer.

A. P. BOLLER.

[Our correspondent's views seem to us eminently sound, as we have indicated in another column, where we have discussed this general question at some length.—ED. ENG. NEWS.]

Chicago Water-Works—Submerged vs. Visible Intakes.

WINNIPEG, Man., July 10, 1890.

TO THE EDITOR OF ENGINEERING NEWS:

SIR: In your issue of July 5 Mr B. FEIND contributes a very interesting account of the work which has recently been done in Chicago toward increasing the water supply.

A part of this work, namely, the "four-mile crib," is estimated to cost over $250,000. The original recom-

mendation made by the Chicago Drainage and Water Supply Commission in 1886 is as follows:

"We believe that a submerged intake will afford a more reliable and safer structure, so far as injury from passing vessels and stoppage by ice are concerned, than a structure projecting above the water."

"With the sewage kept out of the lake there is no need of locating the intake further than two miles from the shore, where water can be obtained sufficiently free from suspended earthy matter, and where a depth of about 30 ft. is generally found, which is the least depth desirable for a submerged inlet."

Mr. FEIND states that the department intended first to have this intake "capped with a bell-mouthed casting, covered by a perforated cast-iron plate a little above the lake bottom," and further that "the plan of a submerged crib was abandoned on account of the difficulty of locating it in dark weather and because of the fear of anchor ice."

It seems to me that the expenditure of so large a sum for an artificial island, to be built four miles out in the lake, is not sufficiently justified by the reasons thus given. As this is a matter of general engineering interest, in view of similar problems arising in other large cities of the Great Lakes, no points having a bearing upon it should be lost sight of. Moreover, some facts indicate rather strongly that the abandonment of the "submerged intake" was not a wise step.

It does not seem clear why or when it is necessary to locate the crib "in dark weather." There is no proof that a submerged intake properly designed becomes obstructed from any cause, so that an immediate examination and cleaning is necessary, and so that time could not be given to wait for proper weather. If the "bell-mouth" has enough open cross-section, so that the velocity of the water passing it is only a few inches per second, or less than the lake currents generally are, there can be no danger whatever from drift or any floating matter being drawn upon it to obstruct the openings.

There is no evidence that anchor ice need be feared, provided stone and iron are avoided in the grating and for the outside of the crib. Anchor ice forms in water cooled to about the freezing point and being at time in the vicinity of certain bodies which are good heat conductors and can readily lose their heat by radiation. For instance, radiation from the stones on the bottom of a river or creek may cause the temperature of the water passing over them or lying near them to be lowered below freezing, when spiculæ of ice are formed which either adhere to the stones, or float in the water, thus forming the anchor ice. These spiculae are not known to form from a bad conductor of heat, such as wood. The material proposed for the new crib and gratings is iron or steel, both very good conductors and therefore for this purpose objectionable when considering the question of anchor ice. But, apart from the above reasonings, it seems to me we have enough actual experience to settle this question. The crib for the Toronto Water-Works intake has been in use since 1882, without having had the slightest obstruction, either from anchor ice or any other cause, as it gives the inflowing water a very slight velocity and has a wooden grating (oak). The Hyde Park intake is another successful example.

The experience we have, therefore, indicates that a submerged intake, if properly constructed, should not cause any fear. On the other hand, it would seem that the new four-mile crib will not be so free from trouble. The iron and steel surfaces and gratings will tend to form anchor ice in clear cold weather. When the lake is frozen to beyond the crib the drift of the ice will exercise a considerable thrust upon the structure, much greater than at the present crib, which is but half as far from shore and somewhat benefited by the shore resistance. The crib may stand this strain, but it will undoubtedly suffer much wear and tear from waves and ice. In view of the above it is certainly not clear that the crib, as proposed, is necessary, requiring an expenditure of more than a quarter of a million dollars, besides the annual cost for a light-house, light keeper, his help and for repairs.

RUDOLPH HERING.

[Our correspondent's conclusions seem sound, but we are not so clear about the reasons in respect to anchor ice which he advances in support of these conclusions. Anchor ice, as we understand it, is formed by the adhesion to submerged objects of the needle-like crystals of ice which first form in running water. In Canada this needle ice is known as *frazil*, and forms in immense quantities in the St. Lawrence and other northern rivers, the water being full of them. By adhesion to the under side of the surface ice the *frazil* greatly increases its thickness and at times closes part of the channel. But why should a comparatively light object like a grating, continuously submerged in a running stream of water, and surrounded by solid non-conductors, have much difference of effect whether of wood or iron? We know that the Toronto submerged intake has answered for years without obstruction, as our correspondent states, but that this effect was due to having wooden instead of iron gratings we very much doubt, in default of evidence that an iron grating under like conditions would choke up. If there is any such evidence, we imagine that the difference is due more to a mechanical cause, the difference of surface, than to difference in conducting capacity.—ED. ENG. NEWS.]

Reducing Internal Waste in Steam Engines.

ITHACA, N. Y., July 19, 1890.

TO THE EDITOR OF ENGINEERING NEWS:

SIR: I always read the NEWS, and usually with unalloyed pleasure; for I think it one of the best periodicals of its class in existence. To-day, however, I find therein an editorial which, as I read it, gives me mingled pain and pleasure.

Happily the latter predominates. I have always had two great ambitions: the one to be able to found a great technical school on my own plan; the other to establish and conduct, if able, a great technical journal, somewhat on your plan.

I see that the writer of this article is in accord with me in anticipating that there "may be" millions in my patent, No. 414,460. I had myself thought it quite certain, until, on handing a copy to a distinguished engineer, who, as I considered, was as capable a judge as any one of my acquaintance, he informed me that it had no interest for him, notwithstanding the fact that he designs and builds many thousand horse power of engines every year. I was then greatly disheartened, and was quite inclined to give it up; but now, I see, there remains some possibility of being permitted, after all, to build up a college, and to sink something in a newspaper as well—provided your judgment and mine are sustained by the facts.

I am much disappointed and somewhat grieved, however, to find that you think the paper a feeble foundation for such super-Corlissian claims as I am supposed to have made. Perhaps you are right, however, and I can imagine that it might have been better to have omitted my estimates of possible saving in practice; though it did not impress me so at the time. I have owned in whole or in part many patents, some of which were hardly less promising than No. 414,460 seemed to me to be, and am as yet not in a position to found a technical school or a newspaper; and I hardly realized the possibility that this might really prove so ambitious, and even so magnificent an invention. I shall even now scarcely dare to hope for so princely a revenue from it as you believe possible.

The process of deduction is nevertheless, a simple one. We have ample proof that it is practicable to reduce the conductivity and heat-storing and wasting power at least 40% by some such process as I have described. The losses, of this kind, in the common forms of simple engine, are usually not less than one-fourth, and are often much more. It is practicable to treat the cylinder-heads, the sides of the piston, and the interior surfaces throughout the ports; and these constitute, probably, fully half the effective heat wasting areas. We shall know, in good time, however, as it is expected that investigations in progress and others planned will settle every doubt. But the paper was not written to make claims, but simply to detail what it was thought might prove interesting results of scientific research, made in a somewhat interesting manner. Its lacunæ will be refilled, I hope, later. The engine tests, of the kind called for in your article, will be for "good and sufficient" reasons, the last to be published. But they will probably settle the commercial questions.

As to the time given to the individual experiments: Forty minutes was found to give as exact determinations as any longer period. The "regime" was established, and unchanging figures were reached. The question of "internal radiation" was considered unimportant. That phenomenon probably plays no sensible part in the method of heat-waste studied. The process of waste is merely the absorption and temporary storage of heat, and is precisely that observed in the surface condenser. A reduction of conductivity, and of specific heat per unit of volume, is what is desired in its extinction. It will give me great pleasure, in due time, to present all necessary proofs of the efficiency of this process. Meantime I am very willing to leave out all specific claims of any kind. Possibly the paper may have some interest for a few specialists on other grounds. It was for them and not for the business men among its readers that it was especially written. Those millions will be none the less welcome, however.

R. H. THURSTON.

[Should Prof. THURSTON realize his ambition of founding a great technical journal, as we trust he may, he will find one of the most puzzling of the many new questions which will arise to plague him that of how to treat those whose services to science are recognized, but who have in some particular instance done something which they should not do. The rule which we have adopted, after much consideration, is to note their supposed wrong doings with even more emphasis than with those less fortunate, "for to whom much is given, of him shall much be required." Acting on this principle it strikes us that the preceding letter only makes the impropriety noted more conspicuous and certain. Prof. THURSTON says the paper was only written "for specialists and not for business men," and yet its very title is "A *Practical Method* for Reducing the Internal Wastes of the Steam Engine." If practical methods are not for practical men, for whom are they? Had the paper been headed "Some Preliminary Experiments to See if there is Any Way by which Something Can Be Done to," etc., he would have headed it truthfully and headed it properly. As it is, he, in effect, claims both in the beginning and the end (and in sundry sentences between) of a paper before a learned society which should be very particular in such matters, to have discovered something which he has not yet discovered, to have accomplished something which he has not yet accomplished, and to have proven something which he has not yet proven. These things should not be.—ED. ENG. NEWS.]

Temperature at Various Depths, Lake Cochituate.

The accompanying diagram, for which we are in debted to Mr. DESMOND FITZGERALD, Resident Engineer, Boston Water-Works, shows in an interesting way the change of temperature at various depths; and also that the temperature in different portions of the lake is, for given depths below the surface, wholly independent of the total depth of the water. Of course the precise figures of the diagram apply only to this particular portion of the

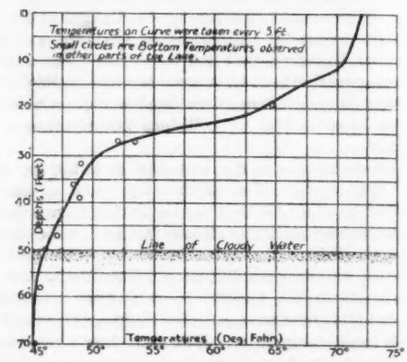


Diagram Showing Temperatures of Water in Lake Cochituate

year; at other seasons it may depart more or less from these conditions, but so far as appears from the diagram both the line of cloudy water and the lines of equal temperature form perfect horizontal planes, regardless of what may be the total depth of the water. In the diagram the round circles indicate observations on the bottom, in the shallower portions of the lake; the continuous line a series of observations in the deeper portions.

Taking Cross Sections in Tunnel Excavation.

MR. F. W. WATKINS described in a paper on "Tunnel Surveying in the Croton Aqueduct," read at the late Am. Soc. C. E. convention, a new instrument for taking cross-sections in tunnels which proved very useful in practice, and is shown in the accompanying cuts. From his paper we abstract as follows:

In tunnel work the cross-sections are usually made by measuring the irregularities of the contour of the section by angles and distances from some point in the vertical plane through the axis of the tunnel and the elevation of that point (or origin of measurements), with reference to the governing grade line, is determined by leveling.

The instruments generally used for this purpose have been, for the most part, rather crude. That used by him for measuring the cross-sections of the Weehawken tunnel was a light pine board shaped like a semicircular protractor and 4 ft. in diameter. Degrees were marked on its circumference for about 200 degrees of angle. This protractor was set on a light wooden easel and braced to a vertical position, with its center in the axis of the tunnel, and the angles and distances then measured by a rod or tape line.

For the new Aqueduct tunnel, where sections were to be made every 10 ft. for over 30 miles of tunnel, it was necessary to provide some instrument that would be more accurate and more convenient to operate.

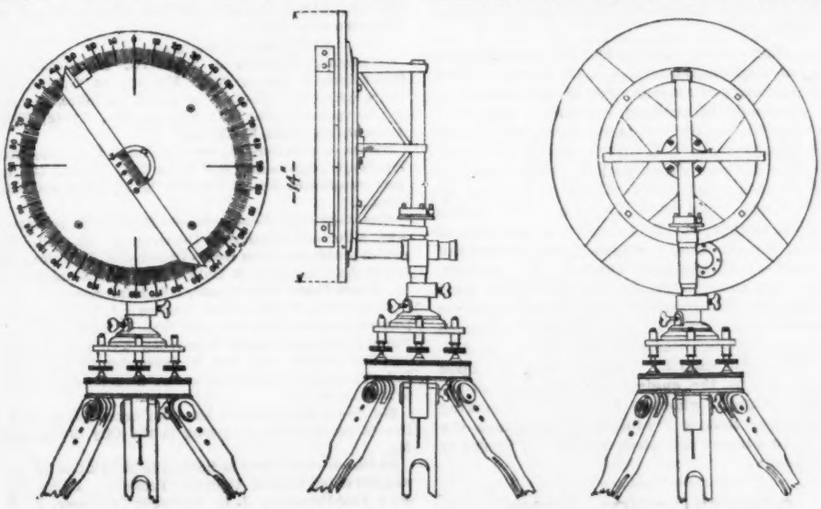
Mr. WATKINS, devised one, consisting of a cir-

cular disk or protractor 3 ft. in diameter and attached to a vertical iron rod, the rod sliding up and down in a socket and regulated by a thumb-screw. It was supported by a tripod made of wrought-iron gas pipe, and had extension legs.

The disk could be set in the plane of the axis and its center raised to coincide with the center of a circular tunnel. Cross-sections could then be taken and the measurements would show at once if any trimming was needed.

One of these instruments was made at the Morris Dock office, with the help of a handy man in the engineer corps. As made it worked well, but was heavy and cumbersome. It could probably have been improved and made much lighter if placed in the hands of a skillful mechanic to manufacture.

Mr. ALFRED CRAVEN, Division Engineer of the Aqueduct Commission, and a member of this society, worked out the problem about the same time, and devised what is popularly known among the Aqueduct engineers as the "Sunflower Instrument" (from its yellow disk of varnished wood). Mr. CRAVEN'S plans were sent to HELLER & BRIGHTLY, instrument makers, who manufactured those used on the new Aqueduct work. The instrument consists of a light wooden tripod with extension legs, a shifting top, ball-and-socket joint, and leveling screws, similar to a light transit tripod. A vertical brass tube slides through this socket and carries at its top a light wooden circular disk or protractor, about 18 ins. in diameter and with its circumference graduated for each degree of the circle, from 0° at the top to 180° at the bottom (Figs. 1-3).



INSTRUMENT FOR TAKING TUNNEL CROSS SECTIONS.

A hard-wood arm or rest, revolving on a central socket, traverses the face of the disk. A wooden measuring rod, about 14 ft. long, is laid upon this rest, or revolving bracket, in front of the disk, and slid out to touch the rock or surface of the tunnel, the end of the supporting arm at the same time pointing to the degree of angle from the vertical.

The measuring rod tapers from 2 ins. to ¼ in. in width, and is graduated for feet and tenths from the small end.

The measurements are recorded in the field book like ordinary cross-section notes, the angle read and distance from the center of the disk, taking the place of elevation and distance out.

To insure the cross-section being taken at right angles with the axis of the tunnel, the disk has a small sighting tube attached and perpendicular to its face; when the instrument is set on line and leveled up, a sight is taken through this tube to a distant line light. The elevation of the center of the disk is then taken before the cross-section is measured; about fifteen or twenty measurements will usually cover all prominent irregularities of the contour of the section.

The areas of these cross-sections can either be calculated from the field notes or the plats measured by the polar planimeter. The latter has been found most convenient for this work, and, when carefully used, remarkably accurate.

Mr. CRAVEN also devised a circular protractor for platting the disk diagrams in the office, which supplements and carries out the same principle for which the Sunflower disk is used in the tunnel.

It is a circular protractor of German silver, 3 ins. in diameter, and graduated from 0° both ways to 180°, and with a transparent horn center, so that it can be placed on the paper and brought to coincide with the elevation of the center of the disk previously marked on the diagram. Four fine needle points on the under side of the protractor keep it in place. A graduated metal arm attached swings around the center and is graduated for feet and tenths on a scale of one-half inch to a foot, on which scale all cross-section plats of the tunnel are made. This arm marks the degrees of angle, and measures the distance from the center of the points of the cross-section contour.

The Benevolent Fund of the Institution of Civil Engineers.

A report just issued gives the following résumé o the history of this useful and well-managed fund:

The Benevolent Fund of the Institution of Civil Engineers was established on Dec. 20, 1864. It has thus been in existence for more than a quarter of a century, and, as there has not been any general issue of the rules in the interval, it may be well to recapitulate, briefly, some of their principal provisions.

The object of the fund is to afford assistance to necessitous (*a*), members of the parent institution and their families (*b*), to the families of deceased members (*c*), to any persons who may have belonged to the institution and have paid their subscriptions for five years consecutively at least and (*d*), to the families of any such persons.

The income of the fund is derivable from two sources—from dividends on investments and from annual subscriptions. In framing the rules it was determined that all donations and bequests received or promised prior to midsummer, 1865, should be considered as capital. At the close of that year the capital, invested in the names of three trustees, was £22,835, while the annual subscriptions amounted to £713. At that date the gross number of members belonging to the Institution was 1,303, and then, and for some few subsequent years, the demands upon the fund were not equal to the income. It had likewise been agreed that accumulations of income, of unexpended donations and bequests not specifically directed to be added to capital, might, in the discretion of the committee of management, be temporarily invested, so as to remain under its control, and thus afford the means, should the necessity arise, of granting assistance in one year to an amount not exceeding twice the income of any preceding year.

At the end of 1887 the donations to capital had increased to £25,539, and the annual subscriptions to £1,089, while the grants, 46 in number, had absorbed £2,372.

In 1888, Lord Armstrong, thinking or foreseeing that the fund might not in the future be able to deal with cases of necessity in an adequate manner, generously offered £5,000 as an addition to capital, if other members of the Institution would in some way contribute a like amount. Early last year the committee was able to inform Lord Armstrong, as the result of a special appeal to the members of the institution to meet his liberal offer, that his condition had been complied with, the donations received or promised up to that time amounting to £3,226, and the new or increased annual subscriptions to £482, which latter capitalized at 17 years purchase, as had been agreed upon, represented a sum of £8,191, making the total £11,417. In reply, his lordship stated, in effect, that if new or increased annual subscriptions were to be treated as income the benefit derivable therefrom might only be temporary, and that his desire had been to see the capital of the fund increased by £10,000. The committee thereupon decided to utilize a portion of the temporary investments on income account to make up the full amount at once, instead of allowing the matter to remain in abeyance for four or five years. Besides Lord Armstrong's noble gift, donations aggregating £3,455 had been received; to complete the necessary £5,000 it was decided to withdraw £1,545 from income account.

The investments on capital account now stand at £37,506, and the annual subscriptions amounted to £1,468, being an increase of 40% in the year. The cases relieved were 45, and the grants represented a sum of £3,077, while the disbursements were exceptionally high, viz., £146, bringing up the expenditure to £3,223, or somewhat in excess of the net income, which was £2,982, a feature which obtained in about the same proportions in the preceding year.

It may be added that the several classes of members belonging to the Institution (irrespective of the students) have increased four fold in the period under review.

The balance-sheet shows a balance to the credit of income of £7,930 against £10,779 in the previous year, the diminution being in part due to the transfer, as before described, of a portion of this balance to capital, in part to the excess of expenditure over receipts during the past two years, and in part to the fact that the previous balance included £1,367 of donations to Lord Armstrong's fund.

JNO. COODE, C. E., Chairman.

The Institution of Civil Engineers,
25 Great George St., Westminster,
February 18, 1890.

DOES ELECTRICITY INCREASE FRICTION is a question which has been much discussed of late. Recent experiments by LOUIS M. SCHMIDT at the Thomson Electric Welding Co.'s works seemed to further confirm the theory that the slight increase in friction which has been observed in experiments with small models is due to an incipient welding. Blocks of copper weighing about 80 lbs., with a contact surface of 30 sq. ins., were subjected to a current of 4,500 ampères and moved along copper guides. It was found that when the surfaces were at rest the coefficient of friction was considerably increased, and that this was due simply to the heating effect of the current and not to any magnetic action. When the surfaces were in motion the effect of the current was much less, but operated on the whole to decrease the friction.

AN EXTENSIVE ELECTRIC TRANSMISSION PLANT will be one of the leading features of the electrical exposition to be held next year in Frankfurt, Germany. The General Electrical Co., of Berlin, and the Oerlikon (Switzerland) Machine Works will install a turbine and dynamo plant at Lauffen on the Neckar River, 100 miles from Frankfurt. The copper conductor to be used will be 0.2 in. in diameter and carried on poles.

THE NORTH SEA AND BALTIC CANAL contractors have some quite heavy cuts to make near Kiel, where a line of hills averaging 110 ft. above the canal level must be crossed. The cost of the excavation varies from 14 cts. per cu. yd. in the sandy districts to 22 cts. per cu. yd. on the Kiel Firth. Near Gruenthal a railway bridge must be built at a height of 130 ft. above the canal level; this height being necessary in order that the largest war vessels may pass beneath it. Three swing bridges will also cross the canal. The engineers believe that the current in the canal will keep it free from ice in winter. Most of the water will come from the Baltic, only 8% being from fresh water sources. The locks are double, 465 ft. long with 98 ft. gates. Nearly 15,700,000 of the total 98,000,000 cu. yds. of material to be excavated have been removed since work began in 1889

EACH WANTED THE EARTH.—Several people have been accused at different times of wanting the earth; but only within a few months has the demand for it become so great that the contestants have taken the matter into the courts. In the operation of a telephone system or an electrical railway line considerable expense is saved if the earth can be used for the return circuit. Generally the telephone companies have been first in the field and have taken the earth for their own use. When the electric railway came, however, and also took the earth, there was music in the telephones of a sort not at all pleasing to the subscribers. The leakage of current from the railway line raised havoc with the feeble telephonic current. In a great number of cases the telephone companies have appealed to the courts to "make the electric railways stop using the earth," but it has generally been held that the fact of prior possession avails nothing, and any one who wishes may have the earth to use. The telephone companies will generally construct complete metallic circuits to get rid of their trouble, and leave the electric railways in serene possession of the earth.

TWO CENTRIFUGAL PUMPS with a capacity of 20,000 galls. per minute have been set at work to reduce the stagnation in the Hamburg canal at Buffalo.

GARBAGE AT ST. LOUIS is to be taken care of by the Merz Universal Extractor Co. The process employs superheated steam to dry the material and the product is sold as a commercial fertilizer. The

process has been approved by Health Commissioner G. F. DUDLEY.

THE WESTERN UNION TELEGRAPH BUILDING one of the oldest of New York City's great office structures, had its four upper stories gutted by fire on July 18. The fire broke out, fortunately, just at a time when the night force of operators was leaving and the day force had not yet reported, and there was no loss of life, although several persons were driven to the roof for escape.

The floors, walls and solid partitions of the building were fire-proof, and stood their severe ordeal well, but the large open spaces and the vast amount of inflammable material in the structure gave the flames plenty of material to feed upon. The worst feature in the construction was the narrow, winding stairways which formed the only means of egress from the upper stories. In rebuilding the structure this serious fault will be corrected. The granite trimmings of the building were badly injured by the heat, furnishing a new evidence of the dangerous character of granite on fire-proof construction.

A BRIDGE OVER BEHRING STRAIT is againunde discussion. Mr. C. L. COLBY and several others have gone to Alaska, for the purpose, it is said, of examining the sites for such a structure. It is stated that the recent visit of Gen. BUTTERFIELD to St. Petersburg was in the interests of the project.

THE LARGEST CHIMNEY IN RHODE ISLAND is being erected in Providence at the Narragansett Electric Lighting Co.'s station. It will be 250 ft. high, with a shaft 14 ft. in diameter. The inner core is built separate from the outer wall, which is octagonal in plan, with a batter of 0.28 ins. per ft. About 1,500,000 bricks will be used in the structure.

THE ADOPTION OF THE METRIC SYSTEM for exclusive use in the customs service is recommended in a letter from the Secretary of State transmitted to Congress by the President, accompanied by a report of weights and measures, unanimously adopted by the International American Congress. The Secretary, in his letter, says:

This report recommends the adoption by the United States of the metric system of weights and measures, which is now in use by the governments and people of all the other American republics and most of the nations of Europe, and which is already authorized by the laws of the United States. The adoption of this system in the customs service would, it is believed, greatly promote the public convenience, and I beg leave to submit, for the consideration of Congress, the draft of a bill for that purpose.

The draft referred to reads:

Be it enacted, That on and after the 1st of July, 1891, the metric system of weights and measures, authorized by the act of Congress, approved July 28, 1866, shall be used exclusively in the customs service of the United States.

A VOLCANIC ERUPTION is in progress in Alaska from Mt. Bogostoff, a low lava cone on one of the Aleutian Islands. Mt. Sheldon, 5,053 ft. high, on a neighboring island, is also showing signs of activity.

A RAILROAD CHURCH has been built at Tiflis, Russia, in the shops of the Trans-Caucasian railway. It is surmounted at one end by a cross and at the other by a belfry and chime of three bells. It seats 70 people and is carried on two four-wheel trucks.

THE COAL WASTE COMMISSION of Pennsylvania has issued a circular letter asking for suggestions and information as to the best means of diminishing waste in the mining of anthracite, and also of utilizing the mountains of culm in the mining districts. The members of the commission are J. A. PRICE, ECKLEY B. COXE and P. W. SHEAFER. It is said that under the present wasteful system of mining, by which hardly one-third of the coal is utilized, the available supply of anthracite will be exhausted in a couple of centuries.

THE AMERICAN SOCIETY OF SWEDISH ENGINEERS has been incorporated in New York with the following as trustees: HENRY SELLMAN, GUSTAVE P. WERN, Brooklyn; ARVID SANDGREN, New York; GUSTAV LEONARD BACKSTROM, CARL ALFRED SUNDSTROM, Philadelphia. The headquarters are to be in Brooklyn.

ISAAC PERAL, the inventor of a submarine boat recently tested by the Spanish Government, has received a title of nobility and a gift of $100,000.

A SURVEY OF THE MISSOURI RIVER from the confluence of the Madison, Jefferson and Gallatin Rivers to Fort Benton, Mont., has been begun by Mr. G. A. MARR, a government engineer. The object of the expedition is to find out if the river can be made navigable.

ASPHALT DEPOSITS on the Uncompahgre Ute Indian reservation in Utah have been prospected by a Denver company. A bill now before Congress will open a part of the reservation to settlement. The deposits will then be developed.

A CLEVER HOAX was perpetrated at the South Kensington, London Musuem, on the occasion of the recent Jubilee of Penny Postage. It purported to be a remarkable new invention, whereby the speaker at a telephone could see before him an image of the face of the one with whom he was conversing, the image being transmitted electrically over a wire. The daily press, as usual, heralded it as a great sensation, and even some technical journals were entrapped into belief in the "Electro-phonoscope." It has finally leaked out, says *Engineering*, that the ingenuous trick was effected by means of a hidden tube connecting the two telephone stations and bent four times at right angles, a mirror being placed at each bend. The interest of scientists in the "Electro-phonoscope" has come to a sudden termination.

THE COLOSSUS OF RHODES has for centuries been flung, so to speak, in our faces as an evidence of the vast superiority of ancient over modern engineers, and thousands of unhappy schoolboys have been compelled to commit to memory its impudent proportions. Now comes M. EIFFEL and demonstrates with slate and pencil that no such statue ever existed or ever could exist. There never lived an engineer who could have placed a bronze statue standing astride of the entrance to the port of Rhodes, for the simple reason that the weight of the body would infallibly have crushed the legs. Let us hope that M. EIFFEL will pursue his good work and demolish the aggravating hanging gardens of Babylon and prove that the exasperating temple of Diana at Ephesus was about the size of an ordinary Methodist chapel. We have been sat upon long enough by the engineering impostors of antiquity, not one of whom ever dreamed of making a statue like that of "Liberty Enlightening the World" or a tower like that built by M. EIFFEL.—*N. Y. Herald.*

CONSTRUCTION NEWS.

RAILWAYS.

EAST OF CHICAGO.—Existing Roads.

Kinderhook & Hudson.—Tracklaying has been completed on this New York railway, and it will be opened for traffic soon. The road runs from Kinderhook to Hudson, N. Y., 16.5 miles, and passes through an active manufacturing and agricultural section. E. G. Ferris, of Hudson, is Chief Engineer.

Pittsburg & Lake Erie.—The extensive improvements which have been in progress for some time on this road are nearly completed. The portion of new line between Pittsburg and Phillipsburg, Pa., will be opened for traffic in about a week, and the line from Phillipsburg to Wampum, Pa., will be completed in about six weeks This will give the company a double-tracked road from Pittsburg to Youngstown, O. The principal improvements have been the lowering of the grades and eliminating many of the sharpest curves, and the construction of a large amount of trestling.

Baltimore & Eastern Shore.—Tracklaying on this road has now been completed from Bay Shore to the Nanticoke River. The bridge across the river is nearly completed and a large quantity of ties and rails are on hand ready for use as soon as the bridge is finished. Goddefroy & Howe, the contractors of this road, have completed a survey of the Wicomico & Pocomoke R. R., with a view to its reconstruction. The road, which is 31 miles long, running from Salisbury to Ocean City, Md., was recently purchased by parties interested in B. & E. S. R. R. and consolidated with it.

Philadelphia & Reading.—About twelve miles of grading have been completed on the line from Hartsville to New Hope, Pa., 16 miles, and tracklaying will begin at once. It is expected to have the line completed by October. The route is through a fine farming section of the country.—The Philadelphia & Seashore R.R. is now completed to within two miles of the beach at Sea Isle City.

Pennsylvania.—It is announced that this company has decided to construct a line from Allentown to Reading, Pa., as a feeder to its Schuylkill Valley Branch. The surveys have already been made.—Surveys are in progress for a narrow gauge line from Newport, Perry County, Pa., up Buffalo Creek to a connection with East Broad Top R. R.—The company is reported to have under consideration a line from Fredericksburg, Va., through the counties of Stafford, King George, Westmoreland and Northumberland to Smith's Point, near the mouth of the Potomac River.

Evansville & Terre Haute.—Tracklaying on the Evansville & Richmond R. R. is progressing rapidly. It is expected that the line will be completed to a connection with the Cleveland, Cincinnati, Chicago & St. Louis R. R. at Westport, Ind., by Aug. 1.

Indiana, Illinois & Iowa.—It is rumored that this company will extend its line from Knox to Warsaw, Ind., a distance of about 40 miles.

Canadian Pacific.—This company has completed arrangements for the purchase of the New Brunswick Ry. comprising about 500 miles of road. This will give the C. P. Ry. a line from ocean to ocean.

Sebastecook & Moosehead Lake.—There is some talk of extending this Maine road from Hartland to Athens, Me.

Intercolonial Ry.—Bids will be received until July 31 for the construction and delivery of eight pairs of 64-ft. steel plate girders at St. Thomas; two pairs of 54-ft. steel plate girders, one at St. Charles and one at L'Islet, and 102 16-in. iron floor beams and necessary connections at St. Thomas. Plans and specifications may be seen at the office of the Chief Engineer, P. S. Archibald, Moncton, N. B., and at the office of G. W. Robinson, 136½ St. James street, Montreal.

Pittsburg, Akron & Western.—Creech & Lee, contractors, Akron, O., advertise for 500 teams and 500 laborers and teamsters.

Projects and Surveys.

Marietta, Hocking & Northern.—Incorporated in Ohio to build a railway from Marietta to Washington, Court House, O., a distance of about 110 miles. Among the incorporators are: L. C. Newson, Geo. Hanley, Felix A. Jacobs and Chas. E. Bidwell.

Western.—Chartered in Ohio to build a railway from Findlay, O., east to the Ohio State line. Among the incorporators are: Wm. E. Snyder, E. H. Jones and John Parker.

Washington & Cumberland.—Books will be opened Aug. 21 for subscriptions to the stock of this road. The road is projected to run from Cumberland, Md., along the bed of the Chesapeake & Ohio Canal to Washington, D. C. Enoch Pratt, of Baltimore, Md., is interested.

Louisville, Richmond & Dayton.—Among the incorporators of this company are: Geo. L. Danforth, J. C. Fawcett, Dennis Long, of Louisville, Ky.; S. A. Culbertson, New Albany, Ind., and R. Ostrander, of Richmond, Ind. The road is projected to run from Louisville, Ky. to Dayton, O.

Zig Zag.—This company has been organized to build a line of railway 1½ miles long in the City of Portland, Me.

Indiana.—Chartered in Indiana to build a line of railway 150 miles long in Indiana. President, Mellin Mercer; Vice-President, J. C. Caldwell; Treasurer, E. W. Hawkes, and Secretary, H. V. Mercer.

SOUTHERN—Existing Roads.

Louisville Southern.—Tracklaying on the Richmond, Nicholasville, Irvine & Beattyville R. R. between Nicholasville and Versailles, Ky., is progressing rapidly and will be completed in about two weeks. From Nicholasville southeast to Richmond tracklaying has been completed to Marble Creek. Work is now delayed by the construction of the Marble Creek bridge. The bridge across the Kentucky River at Tate's Creek is finished, and as soon as the Marble Creek bridge is completed, which will be in about two weeks, tracklaying will be resumed, and it is expected to have the line in operation between Versailles and Richmond by Aug. 15. The grading is practically completed to Irvine, Ky. Rolling stock is being delivered and the road will be put in operation as soon as completed to Richmond.

Middle Georgia & Atlantic.—This road will soon be put in operation from Machen to Eatonton, Ga. Construction is in active progress from Machen to Covington.

Decatur, Chesapeake & New Orleans.—The contracts are reported let for the section from Decatur, Ala., to Shelbyville, Tenn.

Orlando & Lake Jessup.—This Florida road has been completed to a point about 1¾ miles from Oviedo.

Georgia Pacific.—This company is surveying a line from Tallapoosa, Ga., through Willis Valley and over Lookout and Sand Mountains to the Tennessee River.

Atlantic Coast Line.—The location of the line from Fayetteville to Rowland, N. C., 40 miles, has been completed, and as soon as the necessary arrangements can be made the contract for constructing the line will be let. It is expected that work will commence about Sept. 1, and be pushed as rapidly as possible.

Lynchburg & Durham.—This road has been completed to Durham, N. C., 113 miles from Lynchburg, Va., and will soon be put in operation. The company was chartered in 1886, and the first 11 miles of the road from Lynchburg south were completed in 1888. During 1889 the road was extended to South Boston, Va., 49 miles further; the remaining distance to Durham being built this year. Peter J. Otey, of Lynchburg, Va., is President.

Ohio River.—Work is making good progress on the

Ravenswood, Spencer & Glendale R. R., and it is expected to have 17 miles of the line completed this season.

Charleston, Sumter & Northern.—Mr. Wentworth Rollins, General Manager of the construction company which is building this road, states that work on the line from Bennettsville to Sumter, S. C., is progressing satisfactorily. He says:

The contract for grading the line between those points has been awarded to Pringle & Co., who represent the firm of Pringle, McLane & Co. The contract for the trestle work from the Pee-Dee River to Sumter has been awarded to Walton & Robinson, and for that from the Pee-Dee River to Bennettsville to Williams & Tinley. The construction of the bridge over the Pee-Dee River is in charge of the Phœnix Iron Works, of Pennsylvania. Twenty-one miles of the grading have already been completed. The entire line, between Sumter and Bennettsville, a distance of 62¾ miles, will be graded very soon. The line from Sumter to Darlington will be completed by the first of September, and the road between Darlington and Bennettsville will be finished by the first of November. The entire road from Pregnall's to Bennettsville will be in operation by the first of January, 1891.

West Virginia Central & Pittsburg.—At a recent meeting of the directors it was decided to extend this road from Elkins to Beverly, W. Va.

Projects and Surveys.

Rosedale & Mississippi Central.—John T. Kuhn, of Rosedale, Miss., writes us that surveys commenced on this road from Rosedale east July 15. The route is through a fine timber region. Chas. Scott is President and A. Gleson is Chief Engineer.

Autangaville & Northern.—Surveys are being made for a railway from Autangaville to Booth's Station, 7 miles. F. C. Faust, of Autangaville, Ala., is Chief Engineer.

Alabama Mineral.—Incorporated in Alabama to build a railway from Childersburg, Talladega County to Sycamore, Ala. Among the incorporators are: J. O. Stanley, of Anniston, Ala., and J. A. Nichols and Geo. Butler, of Childersburg.

Frankfort, Lebanon & Cumberland.—The preliminary survey for this Kentucky road has been completed, and if sufficient encouragement is received from the towns along the route it is stated that the line will be built. The road is to run from Frankfort, Ky., via Lawrenceburg, Bloomfield and Springfield to Lebanon, Ky.

South Alabama & Tennessee.—The survey for this road has been completed from Jasper to Bessemer, Ala. The country is stated to be very rough. The company has not yet been organized.

Cookeville & Big Creek.—A company has been organized to build a railway from Cookeville to Big Creek, Campbell County, Tenn.

South Mississippi.—This company has completed its organization, electing J. S. Solomon, of Meridian, Miss., President, and J. Hoskins, of Brookhaven, Miss., Secretary, and the following directors: Belton Mickel, Geo. Govern, J. A. Hoskins, J. S. Solomon and R. H. Thomson. Books will be opened at once for subscriptions to the capital stock. The road is projected to run from Natchez to Meridian, Miss., 180 miles.

NORTHWEST.—Existing Roads.

Omaha Southern.—Grading is reported in progress from Union to Plattsmouth, Neb.

Great Northwest Central.—The contract has been let for a 100-mile section of this Canadian road. J. H. E. Secretan, of Brandon, Man., is Chief Engineer.

Chicago, Ft. Madison & Des Moines.—Willard T. Block, of Adams Express Building, Chicago, Ill., writes as follows:

This road was projected to run from Ft. Madison, Ia., via Ottumwa, Des Moines and Greenfield to Council Bluffs, Ia., a distance of 300 miles. The old Fort Madison & Northwestern R. R., which the company purchased, is now being changed to standard gauge and will form part of the new line. The road will be generally easy of construction, with easy grades and curves. The principal business will be in grain, coal, lumber, stone and live stock. E. C. Long, of St. Paul, Minn., has the contract for construction. The road is open for sale. C. A. F. Morris is Chief Engineer.

Projects and Surveys.

Black Hills Central.—Henry E. Bailey, of Rapid City, So. Dak., Vice-President, writes as follows:

The surveys have been completed for this road, which is projected to run from Rapid City, via Castleton, Lookout and Mountain City, to the Wyoming Territory line, a distance of 63.2 miles. The country is mountainous, but as the route follows the water courses a very favorable line has been secured, with moderate grades and curves. The principal business will be the mineral and agricultural traffic. The right of way has been secured over all public lands. George Gregory Smith is President and Gilbert E. Bailey is Chief Engineer.

Winnipeg & Hudson Bay.—It is stated that English capital has been secured with which to build this road.

Kansas, Nebraska & Dakota.—Chartered in Nebraska to build a line of railway from Newton, Kan., northwest through Nebraska and South Dakota, to Devel Lake in North Dakota. The length of the road is about 1,000 miles. The officers are as follows: S. R. Peters, Newton, Kan., President; Oliver J. West, Newton, Vice-President; W. D. Tourtillott, Newton, Second Vice-President; Charles R. McLain, Newton, Treasurer; and W. T. Reed, Kansas City, Kan., Secretary.

Little Wabash.—The officers of this Illinois company are: President, J. J. McCawley, Clay City, Ill.; First Vice-President, Edward Austin, Effingham, Ill.; Second Vice-President, Nathaniel Holderby, Carmi, Ill.; Secretary, N. M. Burnes, Clay City, and Treasurer, Israel Mills, Clay City.

Sioux City & Northern.—Chartered in Iowa to build a railway from Sioux City, Ia., to Deadwood or Rapid City, S. Dak., a distance of 500 miles. Among the incorporators are: John F. Duncomb, of Fort Dodge, Ia.; S. L. Dows, of Cedar Rapids, Ia., and A. S. West, of Sioux City, Ia.

SOUTHWEST.—Existing Roads.

Louisiana, Arkansas & Missouri.—H. H. Myers writes us as follows:

This company was organized in 1888 to build a railway from Brinkley, Ark., to Alexandria, La., a distance of 360 miles. Construction was begun in 1889 at Dermott, Ark., and about 5 miles of the roadbed were completed when the company got into legal difficulties, and no work has been done since. It is now expected that everything will be settled shortly, and that work will be resumed and the line rapidly built.

Shreveport Belt.—The belt line transfer railway at Shreveport, La., will soon be completed.

New Orleans, Fort Jackson & Grand Isle.—C. S. Dwight, of Morris Building, New Orleans, La., Chief Engineer and General Manager, writes as follows:

No track has been laid on this road since March 1, when work was stopped by floods. About 200 men are now at work on the grading, 45 miles of which have been completed, and tracklaying will be resumed early in August. About 27 miles of the road are now completed, and of this 20 miles were built this year. The road as now projected is 76 miles long, with 12 miles of steamboat line, but the line will be extended ultimately. The route is through a practically level country, affording easy grades; maximum curve 4°, and this only in a few cases; it generally being 1° and 2°. The road is being built in the interest of the planters along the route, and with their capital. The principal sources of traffic will be sugar and molasses from the plantations, and the fish and oyster trade. The location of the main line has been completed, and the preliminary surveys made for the branch to Grand Isle. The contracts have all been let for the grading, stations, etc.

Dallas, Pacific & Southeastern.—W. J. Sherman, of Dallas, Tex., Chief Engineer, writes as follows:

About 65 miles of grading have been done on this line which is to run from Dallas northwest 400 miles. The route is through a rolling prairie country affording very easy construction; maximum grade 1% and maximum curves 3°. The principal business of the road will be in lumber, cattle, agricultural products, coal and other minerals.

Projects and Surveys.

Kansas City Link.—William B. Knight, of Kansas City, Mo., Chief Engineer, writes as follows:

The location has been completed for this 27-mile belt line around Kansas City. The object of the road is to provide a transfer for the various railways entering the city and to furnish a suburban rapid transit line. Contracts will be let about Aug. 15. J. Seymour Scott, of Kansas City, is President.

Arkansas & Gulf.—W. R. Bergholz, of 15 Cortlandt St., New York City, President, writes us as follows:

The final location is now being made for this road which is projected to run from the Arkansas River near Pendleton, Ark., via Arkansas City and Lake Village, to the Louisiana State line, a distance of 85 miles. The route is through a cotton and timber region affording easy grades and curves. The principal business will be in lumber, cotton and general merchandise. Nearly all of the right of way has been obtained. No contracts for construction will be let before October.

St. James & Assumption.—A railway company by this name is being organized in Louisiana. Joseph Maille, of 166 Common St., New Orleans, La., is interested. The road will run from Napoleonville to the Texas & Pacific Ry.

St. Joseph & Tarkio.—This company has been organized to build a railway from Tarkio to Savannah, Mo. The road is supposed to be projected in the interest of the Chicago, St. Paul & Kansas City Ry. Co.

Kansas City, Lawrence & Nebraska.—At a recent meeting of the stockholders the following officers were elected: President, W. H. Chick; Vice-President, H. M. Holnen, both of Kansas City, Mo., and Secretary, J. E Jewett, and Treasurer, J. N. Van Hoesen, Lawrence, Kan.

ROCKY MT. AND PACIFIC.—Existing Roads.

Oregon & Washington Territory.—F. Riffle, of Walla Walla, Wash., Chief Engineer, sends us the following concerning the various enterprises which this company has under way:

About 500 men and 150 teams are now at work on the Grays Harbor Division, and the force is being increased. The road will run from Centralia, Wash., via Oakville, Elma, Montesano and Hoquaim, to Grays Harbor City, Wash., a distance of 60 miles. The work is generally light. The principal business will be in lumber, coal, iron, fruit and general merchandise. About 90% of the right of way has been secured. Twelve miles of the road are now graded. It is expected that tracklaying will begin Aug. 15, and that the road will be completed by Jan. 1, 1891. R. A. Habersham, of Centralia, Wash., is the engineer in charge of work.—On the Grand Ronde Division, from Walla Walla, Wash., to Union, Ore., the contractor has about 130 men and 35 teams at work. 21 miles of the road have already been graded. It is expected that the line will do a large business in wheat, cattle, silver and lead ores, bullion and general merchandise. E. S. Clark, Summerville, Ore., resident engineer, is in charge of work.—On the Portland division preliminary surveys are now being made for the line from Hunt's Junction, Wash., to Portland, Ore. One survey is being made along the Columbia River, and the other further north, via the Klickitat and Lewis Rivers. The route will not be decided upon until the completion of these surveys which will be in about 3 weeks.—Nothing has been done on the line from Eureka Flat to Snake River, since the location was completed.

Rio Grande Southern.—About 3,000 men are now at work on this Colorado road, and it is expected to have the line completed from Dallas to Durango, Colo., by Jan. 1, 1891. The first 15 miles will be completed by Aug. 1. Track laying it is thought will reach the South Fork of the San Miguel River by Sept. 1, and Rico, Colo., by Nov. 1.

Northern Pacific.—This company has secured control of the Seattle, Lake Shore & Eastern R. R., and will hereafter operate it as a portion of its system. Construction on the line between Missoula and Wallace, Idaho, is progressing rapidly. Only about 45 miles more remain to be built.

Southern Pacific.—The necessary money has been raised to secure the building of the line from Martinez to Pleasanton, Cal.

Port Townsend Southern.—General Manager McNeill of the Oregon Improvement Co., is quoted as speaking as follows in regard to this road:

The Oregon Improvement Co. is spending about $300,000 a month in railroad building. This line we mean to push through as rapidly as is consistent with good work, and we will be into Portland from four to six months earlier than we agreed to, and the 130 miles of road to Tenino will be finished nearly 8 months earlier than most people have any idea of. We have a large force of men at work on the line from Crockett's Lake to Quilcene, and this section, which is something over 7 miles in length, will be finished in about 30 days. Then there is a surveying and locating party working along Hood's Canal from Quilcene to Union City. The line from Union City to Olympia has been located, and the contract let for construction. We are anxious to have the contractors finish by November, and have offered them a bonus to do so. If the section is done by that time we will put on a ferry between Union City and Quilcene, and during the winter will push to completion the line around the head of Hood's Canal. This work will not be interfered with by the winter season, and we will gain time by having it done. At Olympia, where the headquarters of the construction force at work on the southern sections are, a large force of men is centered, and work is making good progress. The San Francisco Bridge Co. is putting in 350,000 piles in bridging the swamps at and beyond Olympia.

Atchison, Topeka & Santa Fe.—The survey for the line from Mojave to Tejon Pass has been completed, and the engineers are now at work from Tejon Pass north along the San Joaquin Valley.

Projects and Surveys.

Greenwood.—Chartered in California to build a railway from tide water at the mouth of Greenwood Creek, Mendocino Co., thence to the mouth of Alder Creek, a distance of 34 miles, with a branch 8 miles long from the main line to a point 3 miles distant from the mouth of Alder Creek.

Albany & Astoria.—Chief Engineer Barr has nearly completed the survey for the line from Albany to Tillamook. It is stated that if a favorable line is secured grading will be commenced at once.

Washington.—A press dispatch says: The opening up of undeveloped Olympic mountain region has already proceeded so far that two railroads are being surveyed through it. The first of these is being conducted by the Victoria, Crescent Bay & Grays Harbor R. R. Co. It runs from Crescent Bay around Crescent Lake, through a pass at the west end of the lake, along a tributary of the Soldiuk, through the Quillayute and Quinlault country almost due south to Grays harbor. This road is being surveyed under the auspices of the Northern Pacific R. R., and is about 90 miles long. It is proposed to run steamers across the straits to Victoria, where they will connect with the Nanaimo R. R. The scheme also contemplates the construction of a bridge across Queen Charlotte sound to the mainland at the narrowest point. The road runs through a country rich in timber, agricultural and grazing land, and copper and coal deposits.

The other contemplated railway is the Port Angeles Central, of which Judge Wickersham, of Tacoma, is the ostensible head, though he is supposed to be backed by the Northern Pacific. The surveyors for this road are now working up the Elwha River and are rapidly pushing southward. The road will run up the Elwha River from the head of the canyon and wind around among the mountains to the base of the Three Brothers. There it will penetrate the main range by a tunnel 1¼ miles long. Coming out on the headwaters of the Skokomish River, it will pass around Lake Cushman and down that river to a point about 10 miles west of Union City, thence continuing southward to a connection with the Northern Pacific main line at Chehalis. This road will pass through a rich grazing country and will tap the rich veins of copper, iron and silver.

Rio Grande & Utah.—The projectors of this road are said to be making preparations for the construction of the line. The road is to run from a point on the Atchison Topeka & Santa Fé R. R., about 25 miles from Albuquerque N. M., to Durango, Colo., Benj. L. Cook, Santa Fé, N. M., is Vice-President.

FOREIGN.

Congo.—A press dispatch says:

The latest mails from the Congo say that the work on the railroad is making rapid progress. The force now employed numbers 74 Europeans and about 1,000 negroes. There are 10 engineers, 8 superintendents of construction, 33 miners, besides machinists, carpenters, masons, accountants and storekeepers. The road has been graded north along the bank of the Congo to the Leopold ravine, across which a bridge 70 ft. long is being built. It has been settled that the line will skirt the bank of the Congo to the Mpozo River, which it will cross on a bridge about 200 ft. long. It will then ascend the valley of the Mpozo and gain the comparatively level plains south of the Congo.

India.—The Secretary of State has sanctioned the construction of a railway from Cuttack to Bezwada, a distance of about 507 miles. It is the intention to extend the line ultimately to Madras and Calcutta.

Australia.—The construction of a railway from Perth to Geraldton, about 295 miles, has been approved and work, it is stated, will commence at once. The company receives a land grant of 12,000 acres per mile. A press dispatch says:

The Premier has introduced in Parliament a railway bill providing for the construction of 1,077 miles of country lines and 39 miles of suburban lines, the whole to cost $60,500,000, besides a grant from the Treasury of $10,000,000. He said that the scheme was necessary in order to meet

the growth of the population, which, as the census proved, was increasing faster than the population of America. The bill was well received.

CITY TRANSIT.

Dummy Railways are proposed from Mt. Airy to Sulphur Springs, N. C.; from Decatur to Atlanta, Ga.; at Knoxville, Tenn., where S. B. Kinney is interested; at New Albany, Ind., and at Rapid City, S. D.

Cable Railway.—*Brooklyn, N. Y.*—The Montague St. line will probably be operated as a cable road and not by electricity, as stated in our last issue.

Seattle, Wash.—The lines will be extended.

Elevated Railways.—*Chicago, Ill.* The Meigs Co. has applied for permission to extend its track and adopt the New York type of road.

Hoboken, N. J.—The North Hudson County R. R., which owns the Hoboken Elevated R. R., will build a new road from the ferry to West Hoboken.

Sioux City, Ia.—The foundations are practically completed, and work on the superstructure will begin shortly.

Horse Railways are proposed at Holyoke, Mass; Somerville to Raritan and Bound Brook, N. J.; Alexandria, D. C.; Albuquerque, N. M., W. B. Childers is interested; Seattle and Port Angelus, Wash.

Electric Lines.—*Ottawa.*—A 14 mile line will be built by the Imperial Trust Co. of Toronto, Ont.

Orange, N. J.—The Newark Passenger Ry. Co. has received permission to build a trolley road.

Rockville, Md.—A road will be built at once from Tenleyton to Rockville. J. B. Henderson is interested.

Extensions will be made at Bay City, Mich.; Duluth, Minn.; Topeka, Kan.

Lines are proposed from Boston to Brockton, Mass.; Glens Falls, N. Y.; Lynchburg, Va.; Charlotte, N. C.; Rome, Ga.; Memphis, Tenn.; Kansas City, Mo.; Denver, Colo.

New Companies.—Attleboro, Norton & Pawtucket Street Ry. Co., capital stock, $100,000; incorporators, E. S. Norton, W. M. Fisher, and others, Attleboro, Mass. Bellingham Bay Electric Street Ry. Co., Olympia, Wash.; capital stock, $200,000.

HIGHWAYS.

Ontario.—Plans have been prepared for the construction of roads costing $35,760 near Hamilton.

New Jersey.—A highway from Brush Valley to Warwick has been ordered.

Ohio.—Thirty-three miles of new roads will be built in Jefferson Co.

Colorado.—The Jacksonville Toll Road Co. has been incorporated by W. A. Thomas, N. G. Clark and F. D. Catlin to build a road from Neb Creek to Conklin.

BRIDGES, TUNNELS AND CANALS.

Bridges.—*Boston, Mass.*—The following bids were received for the Federal street bridge:

*Shaw & Miller, Boston	$67,467
Alexander McInnis, Boston	75,200
John Cavanagh & Co, Braintree	79,500
W. H. Keyes & Co., Boston	79,668
J. N. Hayes & Co., Boston	90,000
Benjamin Young, Chelsea	94,000

* Awarded the contract.

Rochester, N. Y.—The bridge noted last week to be built over the river at Court St., will consist of 6 deck spans over the river and mill race, and one through span over the canal. It will be a riveted plate girder bridge with two 12 ft. sidewalks of Portland cement and a Medina blocked stone paved roadway.

Columbus, O.—The Smith Bridge Co., of Toledo, O., has the contract for the viaduct connecting Buckeye and Fourth Sts. The contract price is $58,500.

Mt. Vernon, O.—The following bids have been received for constructing the High St. bridge, Mt. Vernon, and the Jackson Ford bridge, Morris township:

	High Street.	Jackson Ford.
Milwaukee Bridge Co.	$9,625	$2,075
Brackin "	9,426	2,088
King "	9,957	2,233
Youngstown "	9,600	2,125
Chicago "	9,670	2,120
Columbus "	9,900	.....
Penn "	9,900	2,250
Mt. Vernon "	9,550	2,050
Queen City "	9,933	2,400
Berlin Iron "	9,673	2,063
Massillon "	9,973	2,180
Wrought Iron "	9,700	2,100
Missouri Valley "	9,773	2,000
Variety Iron Works	9,763	2,100
Vermont Construction Co	9,750	2,150
Lane Bridge Works	9,700	2,200

Roanoke, Va.—Bids for constructing approaches to bridges over the Norfolk & Western and Shenandoah Valley railroads, at Randolph, Henry and Park Sts., in Roanoke City, Va., will be received until noon, Aug. 4, 1890. Plans and specifications may be seen in the office of the City Engineer, in the Court House building.

Roanoke, Va.—The Roanoke Gas & Water Co. is receiving bids for the construction of a bridge across the Roanoke River.

Mayfield, S. C.—A. B. Talley will let contract on July 28 for the construction of a bridge over the South Saluda River.

Columbus, Ga.—The Central R.R. of Georgia will build an iron bridge across the Chattahoochee River. Cost $50,000.

Birmingham, Ala.—The following bids were received for constructing the highway bridge over the railway tracks on 21st. Street. The structure is 924 ft. long. The contract for the larger part of the masonry was let some time ago. The present bids were for the iron work and the masonry for the footings of the viaduct:

Shiffler Bridge Co.	$50,500
Southern " "	37,496
Milwaukee " " design 1	36,577
" " " 2	37,977
Chicago " "	43,698
Smith " "	45,600
Edge Moor " " superstructure only	40,695

The contract was awarded to the Southern Bridge Co., the work to be completed by Nov. 8. The work is under the charge of J. R. Carter, city engineer, with G. Bouscaren, consulting engineer.

Knoxville, Tenn.—The Gay St. Bridge committee report that they have received plans and drawings from several bridge companies, but are in correspondence with others, and until all are received a report will not be made. More time has been granted the committee.

Winona, Minn.—The Winona Bridge Railway Co. has been chartered to build a bridge across the Mississipi river at Winona, to be used jointly by the Winona & Southwestern, Chicago, Burlington & Northern, and Green Bay, Winona & St. Paul railways. The contract for the erection of the bridge has been let to the Union Bridge Co. of New York, and work on the new structure is to commence by Aug. 1. The contract calls for the completion of the bridge by March 1, 1891. D. M. Wheeler, of Winona, is Chief Engineer.

Houston, Tex.—A bridge is to be built across Calhoun and Smith sts.

Waxahatchie, Tex.—J. C. Woodlief will receive bids until Aug. 1 for the construction of a stone bridge across Roger's Spring branch.

Port Angeles, Wash.—A bridge of the Elwha river at this place is being talked of.

WATER-WORKS.

NEW ENGLAND.

Manchester, N. H.—There is talk of constructing a high service system of supplying Wilson Hill.

Franklin Falls, N. H.—The members of the water committee, which has recently submitted a report, are: W. F. Daniell, Chairman; Daniel Barnard, Walter Aiken, and others. The following is abstracted from their report:

The committee is unanimous that works should be built, but has not decided whether they should be built at once or not, nor whether it is best for the town to build, maintain and works, or allow private parties to put them in. The proposed sources of supply are private springs, with Winnipissogee or Penigewasset rivers to draw from in emergencies. A pumping plant and reservoir will be necessary. Estimated cost, $80,000. Analyses and surveys of several sources of supplies have been made.

Milton, Mass.—A meeting will be held on July 30 to consider the consolidation of the Brush Hill and Milton Water Companies.

Attleboro, Mass.—The town has voted to issue $18,000 of 4% bonds for constructing a new water tower.

Fall River, Mass.—The Board of Aldermen has voted to borrow $25,000, to be repaid in 10 years, to be used for the extension of the water service, etc.

Webster, Mass.—Citizens are discussing a new scheme for supplying the town with water at an estimated cost of $60,000 to $75,000.

Woburn, Mass.—An order has been passed by the City Council authorizing the treasurer to hire $6,000 for constructing a new conduit from the pumping station to the reservoir.

Pawtuxet, R. I.—Investigations are being made of the cost of sinking an artesian well.

East Greenwich, R. I.—The East Greenwich Water Supply Co. is running a main to Cowesett.

Naugatuck, Conn.—The construction of a storage reservoir is projected.

MIDDLE.

Franklinville, N. Y.—An engineer has been employed to ascertain whether an adequate supply of water can be found at a proper elevation. The estimated cost of the proposed improvement is $32,000. A vote on the question of expending that amount will be taken on July 31.

Roxbury, N. Y.—The following information has been received from Charles D. Sagmon:

Works are being constructed by the Roxbury Village Water Co. Estimated cost, $17,000. President, C. G. Keator; Secretary, James R. Dart. They are to be completed by Oct. 1. Water will be conveyed by gravity from springs to a 200,000-gal. reservoir. Population, 700.

Le Roy, N. Y.—The town has renewed its contract with Charles F. Prentice for 5 years.

Babylon, L. I., N. Y.—The Long Island Water Supply Co. has made a proposition to the town offering to lay 3 miles of mains, set 30 hydrants, and furnish a water supply at $900 per annum.

Edgewater, S. I., N. Y.—Bonds for $300,000, bearing 6% interest, running 20 years, are being offered for sale by Woodbury, Moulton & Stearns, of Springfield, Mass.

Schoharie, N. Y.—A new main is to be laid from Cold Spring to Main St.

West Troy, N. Y.—Application has been made for more hydrants.

Rochester, N. Y.—A resolution has been passed favoring the rapid extension of the use of meters.

Keyport, N. J.—A vote will be taken on July 29 on the question of expending $600 for investigating the water supply question.

Uniontown, Pa.—It is alleged that water from Cool Spring reservoir is impure, and citizens have notified the water company to abandon it. It is reported to be contaminated with a neighboring drainage system.

Wilkes-Barre, Pa.—Henry C. Folger informs us that $90,000 of 20-year 5% bonds, issued by the Wilkes-Barre Water Co., were sold on July 18.

SOUTHERN.

Morganton, N. C.—The estimated cost of the new works is $20,000.

Greenville, S. C.—The City Council has accepted the bid of the American Pipe Mfg. Co., of Philadelphia, Pa., to build a gravity system of works, taking the supply from Mountain Creek, 200 ft. above the town. A 25,000,000-gall. reservoir will be built. One hundred hydrants are to be supplied at $40 each, and over 100 at $30 each. The work is to commence in 60 days, and the system is to be completed in one year.——Another report states that the Luther C. Wolkins Corporation has been formed by Luther C. Wolkins, of Boston, Mass., and others, to build works. Capital stock, $1,000,000.

Fayetteville, N. C.—It is reported that bids for constructing works are wanted by J. D. McNeil, Chairman Water Committee.

Griffin, Ga.—A contract has been signed for constructing works.

West Point, Ga.—It is proposed to put in a system of works, taking the supply from artesian wells.

Americus, Ga.—Bonds will be issued for $25,000 for extensions and improvements.

Gainesville, Ga.—The Georgia Development Co. has been incorporated by T. J. Cheney, William Hughes and John Martin to build works. Capital stock, $500,000.

Greensboro, Ala.—W. W. Powers, Mayor, has sent us the following information:

Bonds will be issued by the town for constructing works. No estimate of the cost has yet been made. Water will be pumped from artesian wells to a stand-pipe. "Hope to let contract for wells on July 23." The construction of the works will probably be commenced on Sept. 1. Population, 1,900.

Uniontown, Ala.—A complete plant is to be put in. It will include the stand pipe previously described, and a reservoir. The supply will be taken from artesian wells.

Florence, Ala.—Bonds for $200,000 will probably be issued by the water company.

Troy, Ala.—The supply for the new works will be taken from a spring 5 miles distant.

Shelbyville, Ky.—The citizens' vote on the question of building works will be taken on Aug. 12.

Kimball, Tenn.—We have received the following information from W. J. Kelly, Resident Engineer:

Contracts will probably be let in the near future. A company is now being formed. The supply will be taken from a mountain brook, 350 ft. above the town.

Trenton, Tenn.—Mayor M. Oppenheimer is reported as stating the following:

A vote favoring the issue of $20,000 of bonds has been cast, and works are to be constructed within 60 days.

NORTH CENTRAL.

Conneaut, O.—Correspondence with supply manufacturers is solicited by H. D. C. Richards, General Manager of the Hydraulic Constructing Co., Equitable Building, New York City, this company having been awarded the contract to build the new works. There will be 8 miles of 12 to 4-in mains, 75 to 90 hydrants: 2 compound duplex pumping engines, each of 1,000,000 galls. daily capacity; two 70 HP. boilers; stand-pipe, 20 ft. in diameter by 100 ft. high. Preliminary surveys have been made, and contracts will be awarded as soon as prices from manufacturers can be secured. The works are to be completed this year.

Carthage, O.—Harry Simms, Secretary Water-Works trustees, has sent us the following:

Plans and specifications for a pump-house, pipe-laying, etc., are now being prepared. The 6-in. test well has been completed. It is 125 ft. deep, and flows 55 galls. per minute. Bonds for $20,000 have been sold. Other wells will probably be put down.

Hicksville, O.—The following list of bids and awards of contracts were furnished by Secretary W. D. Wilson:

Pipe and special castings, Lake Shore Foundry, Cleveland, O., at $25 per ton; pipe laying, J. J. Rumsey, Findlay, O., at 16 to 26 cts. per lin. ft.; hydrants, Bourbon Brass and Copper Works, Cincinnati, O., at $25 each; valves, Rensselaer Mfg. Co., Troy, N. Y., at $8.20 to $27.25; valve boxes, Bingham & Taylor, Buffalo, N. Y., at $1.75 to $4.40; pumping machinery, complete, Hughes Mfg. Co., Cleveland, O., at $4,570; building, Daniel Weller, Hicksville, O., at $1,395.

Portsmouth, O.—The Portsmouth Foundry & Machine Works has been awarded the contract for furnishing the new pumps and machinery at about $20,000.

Mount Vernon, Ind.—Mayor McDonald will recommend that measures be taken to have the water company place filters in the reservoirs on the Silver Hills, to render the water supply more wholesome.

Terre Haute, Ind.—Twelve new filters are now being used with gratifying results. Bids are being received for constructing a reservoir. It is to be 15 ft. deep, 10 ft. below the surface, and 5 ft. above. It is to be a storage reservoir, and will be filled with filtered water.

Iron Mountain, Mich.—We have received the following information:

The city granted a franchise for works to W. R. Coats & Co., Owoso, Mich., on July 21. The works will be of a type known as Coats' elevated reservoir system, and will consist of about 15 miles of mains, 160 hydrants, an elevated reservoir of 500,000 galls. capacity, and a pumping plant of 3,000,000 galls. capacity per 24 hours. Work will be started at once.

Genoa, Ill.—H. A. Perkins has sent us the following:

There was some talk of putting in a tank, to be supplied from a well, for fire protection, but the project has been dropped for the present. Population, 750.

Quincy, Ill.—It is reported that a new 5,000,000-gall. pumping engine will be erected.

North Springfield, Ill.—The village trustees have considered informally a proposition to organize a stock company to furnish water, and several persons expressed a willingness to take stock. A committee of four has been appointed to investigate the matter.

Winnetka, Ill.—R. S. Moth writes: No work contemplated at present.

Galesburg, Ill.—Forrest Cook has made a proposition to the City Council to sell the old works for $30,000.

Rhinelander, Wis.—We have received the following information:

Moffett, Hodgkins & Clarke, of Syracuse, N. Y., were awarded the contract in June for putting in a $75,000 to $80,000 system of works. Work is to be commenced this month or they forfeit the contract, which calls for 5¼ miles of pipe, 70 hydrants at $3,600 per annum, and a 2,000,000-gall. pumping engine. Water is to be pumped from sunk wells to a stand-pipe. The population is 3,400.

NORTHWESTERN

Iowa Falls, Ia.—An election will probably be held to vote upon the question of constructing works.

Shaller, Ia.—Advertisements for bids for putting in works have been published.

Keokuk, Ia.—The artesian well is down 1,747 ft. A good flow of water has been obtained, but it will be sunk deeper.

Correctionville, Ia.—A system of works will probably be established. Dr. A. J. Weeks and George Fitchner are investigating different systems.

Mankato, Minn.—The artesian wells are a success.

Garnett, Kan.—The town has voted to issue $30,000 of bonds for putting in works.

Hiawatha, Kan.—An engineer is perfecting plans for bringing water to the city from wells on the Schilling farm, a good supply of water having been secured from that source.

Oswego and El Dorado, Kan.—The Oswego Water Works Co. has been incorporated by J. F. Thompson, C. L. Harris, G. H. Parkhurst, D. W. Weidman and A. B. Ewing, all of El Dorado. Capital stock, $50,000.

Topeka, Kan.—The Interstate Water & Electric Power Co., of Wyandotte Co., Kan., and Jackson Co., Mo., has been incorporated at Topeka. Capital stock, $1,000,000. The directors are: John B. Colton and John G. Johns, of Kansas City, Mo.; Nicholas Mc-Alpine, David N. Carlisle and Robert McAlpine, of Kansas City, Kan.

Duluth, Minn.—Judge Stearns has decided against dissolving the temporary injunction restraining the Duluth Gas & Water Co. from connecting its mains with other mains in Superior.

Yankton, So. Dak.—The North Side Water Co. has applied for a franchise.

Mitchell, So. Dak.—We have received the following from W. A. Rogers:

The date for opening bids for sinking a well has been postponed to Aug. 4.

Cheyenne, Wyo.—Improvements and extensions to the water system are being discussed, and the press of the city is urging the expenditure of $200,000 in the work.

Chinook, Mont.—We have received the following from J. W. Stam:

Work on an artesian is about to be commenced. It is expected to be completed in 40 days. Nothing further than this and the organization of the Chinook Artesian Well Co. has been done.

SOUTHWESTERN.

Kansas City, Mo.—A conference committee has been appointed to reconsider the proposed amendments to the city's charter, to authorize the issue of bonds for owning and maintaining its own works, etc. A resolution has also been presented to the City Council, providing that $10,000 be taken from the Board of Public Works' fund, and used to extend mains to distant parts of the city.

Little Rock, Ark.—The town is considering the question of issuing $200,000 of bonds.

Dallas, Tex.—Plans for the new pumping station have been prepared by J. D. Cook, of Toledo, O., and submitted to the City Council. The estimated cost of building and equipping the station is $215,500.

Corpus Christi, Tex.—The Corpus Christi Water Co. has filed its charter. Capital stock, $20,000.

Gatesville, Tex.—Benjamin Worley is reported as stating that a stock company has been formed to sink an artesian well and put in works.

Berkeley, Col., (A suburb of Denver)—The Continental Land & Security Co., of Boston, Mass., has contracted with the Beaver Brook Water Co. to lay 21,000 ft. of 6 and 8 in. mains.

Littleton, Col.—It is understood that the plan of the new works contemplates the driving of a series of artesian wells, and the pumping of the supply into a reservoir, thence through Littleton by natural pressure. Two acres of land have been asked for, one mile east of the town, on which to build a reservoir.

Trinidad, Col.—The City Council has passed an ordinance authorizing the issue of $100,000 of bonds for constructing a new system of works. The ordinance passed last year granting the company a 30-years' franchise has been repealed.

Boulder, Col.—Bids will soon be wanted for constructing a 50 by 100 ft. reservoir, in accordance with plans and specifications which have been ordered to be prepared by the City Council. The walls will be of concrete and the floor cemented. It is to furnish water for the main reservoir, near the city, by gravity.

PACIFIC.

Dayton, Wash.—A large vote has been cast in favor of the city issuing $55,000 of bonds for putting in a complete system of new works.

Ellensburgh, Wash.—The City Council has passed a resolution directing that bids be invited at once for $150,000 of bonds for completing the works.

Oregon City, Ore.—The City Council has passed an ordinance ordering a special election on July 28 to vote a special tax for raising funds for erecting and furnishing a pumping station to furnish an adequate supply of water for fire protection.

San Francisco, Cal.—The following is from the annual report of the Spring Valley Water Co., as abstracted by the *Call:*

The dam at Crystal Springs has been raised 13 ft., and it is hoped to add 17 ft. more by the end of the year. The engineer has found a more economical way of transporting the water of the San Francisquito watershed to Crystal Springs Lake than by the 24,000 ft. Searville tunnel By adopting a different route there will be two tunnels: one 1,546 ft., the other of 6,937 ft., and a pipe line of 26,520 ft., all of which can be completed at a cost of $500,000 less than the 24,000-ft. tunnel.

San Diego, Cal.—The proposition of the San Diego Flume Co., to furnish the city with a 300,000,000 galls. water supply at $30,000 per year, will probably be accepted. The city would construct and own the distributing system, for which the company would pay a yearly 10% rental of the cost price.

Lodi, Cal.—O. G. Hemphill has sent us the following:

G. G. Buckland is building the works and is to own and maintain them. Water will probably be pumped to a tank. Population, 1,000.

CANADA

Cote St. Antoine, P. Q.—The vote on the question of issuing $100,000 of bonds was taken on July 21.

Gananoque, P. Q.—F. J. Story has sent us the following:

A vote will probably be taken in July on the by-law providing for the construction of a system of works. A report has been submitted by Willis Chipman, of Toronto, Ont., estimating the cost at $43,000. His plans provided for a stand-pipe or tank, pumping station, with machinery, etc.

Lachine, P. Q.—The Chapman Valve Mfg. Co., of Indian Orchard, Mass., will furnish the valves and hydrants for the new works through R. H. Buchanan & Co., of Montreal, their Canadian agents.

New Westminster, B. C.—D. McGillivray has been awarded the contract for putting in complete works. The contract price is about $150,000. The supply will be taken from Coquitlam Lake.

Vancouver, B. C.—The city is negotiating with the water company for the purchase of the existing plant, and proposes to extend the system to Fairview, a suburb.

ARTESIAN WELLS.

Elgin, Tex.—A petition is being circulated to procure the incorporation of the town. If successful a well will be put down.

Forney, Tex.—A stock company will probably be organized to sink wells.

Kerrville, Tex.—A well is being sunk.

Yuma, Col.—It is proposed to sink a well. Address D. C. Donichey.

IRRIGATION.

Kansas City, Mo.—The Anton Chico Irrigating Ditch Co. has filed articles of incorporation at Santa Fé, N. M. The incorporators are: George F. Winter, Robert L. Winter and Cassius M. Gilbert, of Kansas City, Mo.; William J. Mills and Wilson Waddingham, of Las Vegas, N. M. The capital stock is $5,000,000. Its purpose is to construct and maintain water storage reservoirs, canals, ditches and pipe lines, and for the colonization and improvement of lands. It proposes to construct two irrigating ditches to divert the water of the Pecos River, near San Miguel, and bring it upon lands in southern San Miguel County.

Julesburg, Col.—A company has been formed to put in an irrigating ditch on the south divide between Julesburg and Holyoke. Capital, $1,000,000.

Santa Fé, N. M.—Two tubular wells will probably be sunk at the Government Indian school for supplying water for irrigating the grounds.

Boise City, Idaho.—W. C. Bradbury & Co., of Denver, Col., railroad and canal contractors, have been awarded the contract for constructing the New York canal. This canal heads in the Boise River, about 10 miles above this city. It is to be 45 ft. wide on the bottom, 81 ft. wide on top and 12 ft. deep. The main canal is 90 miles long, and there will be about 90 miles of laterals. The contract includes headworks, dams, reservoirs and masonry complete, and provides that the entire work is to be completed by May 1, 1891. Estimated cost, $1,000,000. The canal will cover about 250,000 acres of land, and terminates on the bank of the Snake River at the extensive placer grounds of the Idaho Mining and Irrigation Co., who are to at once commence the erection of extensive mining plants. W. C. Bradbury & Co. have recently completed the Phylis Canal, which heads in the Boise River about 15 miles below this city, and crosses the delta to the Snake River, a distance of 54 miles.

Salt Lake City, Utah.—We have received the following:

The officers of the Swan Lake Canal Co are: President, W. H. H. Spafford; Manager, M. F. Sturges. Capital stock, $300,000. Engineers have been at work for some time, and contracts for grading have been let. About 25,000 acres will be reclaimed. — The works of the Huckhorn Reservoir and Canal, near Price, Utah, have been completed. About 3,000 acres will be reclaimed. The headquarters of the company are at Salt Lake City. President, W. Bryant.

SEWERAGE AND MUNICIPAL.

Paving has been ordered in the following cities: Toronto, Ont., Cedar block; New York City, granite block; Brooklyn, N. Y., cobblestone; Newark, N. J., Allegheny City, Pa., Wilkensburg, Pa., brick; Columbus, O., asphalt, granite block or brick; St. Paul, Minn., cedar block and granite curb; Duluth, Minn., Omaha, Neb., Houston, Tex., brick or asphalt; Salt Lake City, Utah, asphalt; San Francisco, Cal., macadam and basalt block.

Buffalo, N. Y., has prepared assessment rolls for asphalt pavement amounting to $164,000.

Pittsburg, Pa., has voted $124,000 for grading, curbing and pavement.

Ashland, Ky., will issue $50,000 improvement bonds.

St. Louis, Mo., proposes to spend $67,900 for street improvements. A considerable amount of Telford pavement has been ordered.

Denver, Colo.—The new paving ordinances call for 18,882 sq. yds. asphalt 2.5 ins. thick on a 6-in. concrete bed; 1,749 sq. yds. granolithic paving, 2.5 ins. thick on 6 ins. concrete; 1,538 sq. yds. stone paving on 6 ins. concrete; 8,427 lin. ft. 6-in. stone curbing; 1,248 lin. ft. 6-in. stone subcurb; 30,000 lbs. cast iron gutter bridges; 736 ft. cement or salt-glazed sewer pipe 12 ins. in diameter; 692 ft. 15-in. pipe; 346 ft. 18-in. pipe; 692 ft. 21-in. pipe; 246 ft. 27-in. pipe; 7 brick manholes; 12 catch basins.

Sewers have been ordered in the following cities: Buffalo, N. Y., 10, 12, 15, 18-in. pipe, and 21, 24, 27, 39, 48, 54-in. brick sewers; Rochester, N. Y., pipe; Brooklyn, N. Y.; Newark, N. J., pipe; Pittsburg, Pa., 15 and 20-in. pipe, 36, 42 and 57-in. brick sewers; Allegheny City, Pa.; Dalton, Ga.; Cincinnati, O.; Duluth and St. Paul, Minn.; Omaha, Neb.; Los Angeles, Cal.

Woonsocket, R. I., contemplates building a chemical sewage purification plant or purchasing land for filtration beds.

Washington, D. C.—Plans for a complete system, costing $3,598,000, have been prepared by Rudolph Hering, S. M. Gray and F. P. Stearns.

Florence, Ala., has had a complete system planned by Nier, Hartford & Mitchell, of Chattanooga, Tenn.

Walkerville, Mich.—The City Council intend engaging an engineer to design a sewage purification system.

Appropriations have been made as follows: La Salle, Ill., $30,500; St. Louis, Mo., $121,320; Lincoln, Neb., $14,000; Kansas City, Mo., $100,000.

Broken Stone.—***New York City.***—D. E. Donovan offered 600 cu. yds. to the Dock Department at $1.66 per cu. yd.

Bonds.—***Salisbury, N. C.***, intends issuing $100,000 of sewerage bonds.

Denver, Col., will sell $250,000 of public improvement bonds.

Grand Forks, N. D., will issue $50,000 of sewerage bonds.

ELECTRICAL.

Electric Light.—***St. Johns, N. B.***—The New Brunswick Electric Light Co. has been incorporated with $250,000 capital.

London, Ont., proposes introducing 1,000 and 2,000 CP. street arc lamps.

Beverly, Mass., will put in a street lighting plant. F. J. Crowell is interested.

Charlottesville, Va., intends to establish electric lights, water-works and sewers. J. M. Levy is interested.

Monroe, N. C., has appropriated $20,000 for lights and street improvements. Address the Mayor.

Newton, Ia., voted $13,000 for an incandescent plant.

San Francisco, Cal.—The Post Office will be lighted by incandescent lamps.

New Plants are proposed at Chester, Pa.; Alexandria, Va.; Waynesboro, Ga.; Anniston, Ala.; Cleveland, Tenn.; Flemingsburg, Ky.; West Indianapolis, Ind.; Corinth, Miss., address R. P. Barnhill; Greenville, Tex., address the Mayor; Dawson, Tex., address mayor; Arkadelphia, Ark.; Fort Pierre, S. D.

Extensions of plants will be made at Milledgeville and Gainesville, Ga.; Detroit, Mich.; Council Bluffs, Ia.; Oregon City, Ore.; Centralia, Wash.

Electric Transmission of Power.—***Olympia, Wash.***—A dam is to be built across the Des Chutes river

near the city, making a 30 ft. fall. This will give from 400 to 600 HP. to the 6 dynamos of the plant. The current generated will be used for electric light and power purposes in this city.

CONTRACTING.

Dredges.—Wheeler & Pursell, of Jolly, Calhoun County, Iowa, offer two dredges for sale. See advertisement elsewhere.

Pavements.—*Montreal, P. Q.*—The average price during the past year for 3 × 6 × 9-in. tamarack blocks on 6 ins. of concrete was $2.87 5-6 per sq. yd. Trinidad asphalt cost $2.80 per sq. yd.; Sicilian asphalt, $3.00. Red granite blocks with cement joints on 6 ins. of concrete cost $3.83 per sq. yd. The prices per square yard for sidewalk paving were: New York bluestone flagging, $3 to $3.22; granolithic cement, $3 to $3.50; firimite cement, $3; Baccerini cement, $2.50; limmer asphalt mastic, $2.59; asphalt tiles, $2.65. Recent contracts were let at the following prices: granite curb, $1.25 per yd.; tamarac blocks, $1.75; laying, $2.40 to $2.50 per sq. yd.; granite blocks and laying. $4.44 to $5.15; Sicilian asphalt, $3.97 to $3.99; Trinidad asphalt, $3.43.

Brooklyn, N. Y.—Recent prices were $2.39 per sq. yd. for repaving; 55 cts. per lin. ft. for new curb; new bridge granite, 70 cts. per sq. ft.; new bridge, cobblestone, 50 cts per sq. in.; reflagging, 5 cts. per sq. ft.

Rochester, N. Y.—The Warren-Scharff Asphalt Paving Co. has the following contract: 11,100 sq. yds. asphalt $2.75; 6,945 lin. ft. curbing, 34 cts.; 300 lin. ft. crosswalk, 8 ft. wide, $2.50; 210 ft. 12 in. sewer pipe, $1; 6 surface, sewers, new, $24; 23 surface sewers, repaired, $10; 50 lateral branches, 14 ft. long $8; 50 lateral branches, $11; two manholes, $30; adjusting 12 manholes, $3; 60 water service pipes. 24.5 ft. long, $14; 70 water service pipes, 5.5 ft. long, $6; total, $36,526. The Rochester Vulcanite Paving Co. has the following contract: 15,880 sq. yds. asphalt, $2.75; 9,200 ft. new curb, 40 cts.; 640 ft. 8-ft. crosswalk, new, $2.25; 200 lin. ft. 12-in. sewer pipe, $2.50; 5 surface sewers, new, $24; 28 surface sewers, $5; 100 14-ft. lateral sewers, $16; 11 manholes adjusted to grade, $1.50; 47 24-ft. water service pipes, $15; 47 8-ft. water service pipes, $9; total, $52,157.

Albany, N. Y.—A. N. Brady has received a contract for Trinidad asphalt, amounting to $213,758.

Troy, N. Y.—Recent bids by the Sicilian Paving Co. were as follows: Asphalt with 15 years' guarantee, $4.95 per sq. yd.; new bridging, 50 cts. per lin. ft.; new curb, 85 cts. per ft. The bids of the Warren-Scharf Co. were: Asphalt with 15 years' guarantee, $4.05 per sq. yd.; new bridging, 50 cts. per ft.; new curb, $1.15 a ft.

Chattanooga, Tenn., has awarded an $85,000 contract to the Warren-Scharff Asphalt Co., of New York City.

Lexington, Ky.—The Southern Construction Co. has a contract for vitrified brick on macadam foundation, at $2.35 a sq. yd.

Detroit, Mich.—The following contracts have been awarded: 81,955 sq. yds. asphalt for $223,215 to Col. Robinson, and 32,100 sq. yds. asphalt to the Warren-Scharf Co. for $75,733.

Omaha, Neb.—Recent prices are as follows: Sheet asphaltum, $2.34 to $2.78 per sq. yd.; Sioux Falls granite $2.27 to $2.37; Colorado sandstone, $2.12½ to $2.27; Woodruff (Kan.) sandstone, $2.19 to $2.27; Galesburg brick, $2.03 to $2.14; cedar blocks, $1.37½ on sand and plank to $1.61 on concrete; cypress blocks, $1.37½ to $1.62. Curbing prices per lin. ft. were, for Berea sandstone, 69c., and Colorado sandstone, 71c. to 79c.

San Francisco, Cal.—Bituminous rock pavement contracts have been let recently at 21c. per sq. ft.

Excavating.—*Salt Lake City, Utah.*—Recent prices were 35 cts. per cu. yd. for dirt and $3.20 per cu. yd. for rock.

Sewers.—*Kansas City, Mo.*—A contract for 1,558 ft. 6-ft. brick sewer, 331 ft. of 6½-ft., 664 ft. of 8¼-ft., 12 manholes, 50 cu. yds. rubble masonry, 100 cu. yds. cement concrete, 100 cu. yds. rock excavation, 5,000 ft. lumber, 1,000 cu. yds. broken stone, was awarded to J. T. Kelley for $29,466. A contract for 787 ft. 10¼-ft. brick sewer, 843 ft. of 11-ft.; 733 ft. 11¼-ft.; 571 ft. of 11½-ft., 12 manholes, 100 cu. yds rubble masonry, 200 cu. yds. cement concrete, 15,000 ft. lumber, 50 cu. yds. rock excavation, 100 cu. yds. broken stone, 1,500 cu. yds. earth excavation was given Bricker, Douglas & Co., at $59,750.

Cement.—*Baltimore, Md.*—Contracts have been given to S. M. Hamilton & Co., for Cumberland cement at $1.12 a barrel, to C. C. McColgan & Co., for Portland, at $2.78 per barrel, and to J. Bullock & Son., for Round Top, at $1.12 per barrel.

Laying Water Pipe.—*Milwaukee, Wis.*—Thatcher & Breymann, 10,000 ft. 60-in. iron pipe in Lake Michigan for the water-works at $6 per ft.

Dredging.—*Black Rock, N. Y.*—187,000 cu. yds. at 15 cts. for earth and $2.47 for rock per cu. yd.

Spikes.—*New York City.*—A contract was awarded to H. A. Rogers, at the following rates; 6,000 lbs. 10 × 7-16 in 2.3 cts. per lb.; 2,000 lbs. 7 × ⅝ in., 2.4 cts.; 4,000 lbs. 6 × ⅝ in., 2.4 cts.

Electric Lighting.—*Lawrence, Mass.*—The city has contracted with the Lawrence Gas Co. to furnish 70 2,000 CP. arc lamps at $100 each per year, and with the Edison Illuminating Co. for 500 or more 20 CP. incandescent lamps at $1.50 each per night, to burn until midnight, and 150 similar lamps to burn all night at $3.04 each.

New York City.—Bids for 627 arc lamps at 35 cts. each per night have been accepted.

PROPOSALS OPEN.

Paving.—*Brooklyn, N. Y.*—Flagging sidewalks. J. J. Adams.

Pittsburg, Pa.—1,393 sq. yds. brick. W. M. Galbraith. July 28.

Lexington, Ky.—Three miles vitrified brick. J. M. Corbin, City Engineer. No time limit.

Greenbush, N. Y.—Granite block. Street Committee. July 29.

Avondale, O.—Artificial stone sidewalks. W. E. Wynne. Aug. 4.

Cleveland, O.—Grading, draining and paving with Medina sandstone. C. G. Force, City Engineer. July 28.

Columbus, O.—Asphalt, Hayden or Hallwood block fire-clay or hard-burned brick. F. M. Seater. July 29.

Denver, Col.—2½ ins. asphalt on 6 ins. concrete, with storm sewers, inlets, curbing, etc. F. B. Crocker. Aug. 16.

Portsmouth, O.—Address Mayor.

Grading.—*Terre Haute, Ind.*—F. H. Cooper. Aug. 19.

St. Paul, Minn.—R. L. Gorman. July 28.

Philadelphia, Pa.—75,000 cu yds. of earth excavation, average haul 700 ft. J. Pitzman, 615 Chestnut St. July 29.

Stone Curbing.—*Cumberland, R. I.*—3,500 lin. ft., including 16 corners, P. F. Kinion. Aug. 2.

Paving Material.—*Toronto, Ont.*—40,000 ft. B. M. 4 in tamarac planks, 8 to 12 ins. wide; 6,000 lin. ft. 6 in. curb in pieces not less than 4 ft. × 2 ft. 6 ins., and of a material equal to Medina sandstone; 150 lin. ft. similar curb cut to radius of 9 ft. 6 ins.; 1,720 lin. ft. stone flags, 4 ins. × 8 ft. × 4 ft. John Shaw. July 29.

Sewers.—*Boston, Mass.*—Sections 8, 9, C and D of the Metropolitan sewerage system. 19,600 ft. of 6½ to 15 ft. brick sewer, including excavation and piling. Metropolitan Sewerage Commission, 93 Lincoln St., Aug. 13.

Newark, N. J.—400 ft. 2½ × 3½ ft. brick sewer, 650 ft. of 15-in. and 550 ft. of 12-in. salt-glazed pipe sewer, 10 manholes, 7 basins. E. B. Gaddis. Aug. 4.

New Albany, Ind.—Address the Mayor.

Providence, R. I.—2,550 ft. 12 in. pipe sewer and 445 ft. 18 in. brick sewer; materials furnished by the city. J. A. Coleman, July 28.

Gravesend, N. Y.—Furnishing and laying cement pipes, cast-iron flushing mains and hydrants. Board of Health, Coney Island, July 28.

New York City.—Pipe sewers, Dept. Public Charities, Aug. 6. Repairing brick sewers. T. F. Gilroy, Aug. 5.

Washington, D. C.—Terra cotta and brick sewers and receiving basins. J. W. Douglass, July 31.

Cleveland, Ohio.—C. G. Force, July 31, Aug. 7. South Omaha, Neb. 2,870 ft. 2½ in., and 400 ft. 12 in. pipe. E. Connelly, July 28.

Steam Pump.—*Goshen, Ind.*—Compound non-condensing type of 1,500,000 galls. daily capacity, with heater, feed pump, steam and water connections. Lew Wanner, Aug. 7.

Bridges.—*Montgomery, Ga.*—Iron lattice bridge of 130 ft. span. C. A. Allen, Aug. 18.

Intercolonial Ry.—8 pairs 64 ft. steel plate girders, 2 pairs 54 ft. steel plate girders, 102 14 in. iron floor-beams.

Gloversville, N. Y.—Three highway bridges. B. Baker, City Engineer.

Electric Light Plant.—Mare Island Navy Yard. Bureau Docks and Yards, Washington, D. C. Sept. 1

Bridge Approaches.—*Roanoke, Va.*—For 3 bridges. J. A. McConnel. Aug. 4.

Repairing Iron Pier.—*Lewes, Del.*—Maj. C. W. Raymond, 1,428 Arch St., Philadelphia, Pa. Aug. 15.

Dredging.—*New York City.* 134,500 cu. yds. Dept. of Docks. Aug. 7.

Albany, N. Y. 30,000 cu. yds. E. Hannon. Aug. 1.

Buildings.—*Lowell, Mass.*—Post Office. Jas. H. Windrim, Washington, D. C. Aug. 6.

Salt Lake City, Utah.—Joint city and county building. Louis Hyams. Aug. 11.

Bonds.—*Brooklyn, N. Y.*—$1,850,000 water and sewer bonds. T. F. Jackson, July 31.

Cincinnati, O.—$100,000 city hall bonds, E. Stevens. Aug. 2.

Denver, Col.—$250,000 improvement bonds. F. B. Crocker. Aug. 16.

Approaches to St. Clair Tunnel.—*Sarnia, Can.* and *Port Huron, Mich.*—J. Hickson, Montreal. Aug. 9

Building Jetties and Dredging.—*Shinnecock Canal.*—4,300 ft. piles, 10,600 ft. b. m. yellow pine timber, 4,500 ft. b. m. hemlock timber, 3,800 lbs. wrought iron, 650 cu. yds. filling, 38,000 cu. yds. dredging. E. Hannon, Albany, N. Y., Aug. 1.

Retaining Wall.—*Newark, N. J.*—360 cu. yds. stone masonry, 1,000 sq. yds. trap rock paving, 500 ft. 20-in. curb, 5,000 sq. ft. 5-ft. flagging 2 ins. thick, 1,300 cu. yds. earth filling, 2 basins. L. E. Kane. July 31.

Railway Work.—Twenty three miles of the Leavenworth & St. Joseph Ry. McArthur Bros., St. Paul, Minn

MANUFACTURING AND TECHNICAL.

The Wells Light, made by Keegan & Halpin, 44 and 46 Washington St., New York, and illustrated in our issues of Aug. 20 and Nov. 16, 1889, is getting to be extensively used; 400 are reported sold within a few months, 100 to the Pennsylvania R. R. for wrecking and construction. The Norfolk & Western R. R. has placed 3 on each of its wrecking cars. The manufacturers state that over 4,000 have been sold in England in the last 10 years; the Manchester Ship Canal has 459 in use.

Cars.—The Merchants' Dispatch Co. has ordered 250 refrigerator cars. The Denver & Rio Grande R. R. has contracted for 65 passenger coaches to be delivered Sept. 1. The Lafayette Car Works are building 550 oil-tank cars, holding 72,000 galls. each. Of these, 325 are for the American Cotton-oil Co., and the others for the Manhattan Oil Co. The same company has nearly finished 1,000 cars for the New York, Ontario & Western Ry.

Locomotives.—The Illinois Central R. R. has awarded a contract for 25 engines to the Brooks Work at Dunkirk, N. Y. The Indianapolis division of the Pennsylvania R. R. recently received 3 heavy freight locomotives from the Altoona shops.

Car Works.—Chas. Webster, of Phillips, Wis.; Ed Gilbert, of Oshkosh, Wis., and others are reported to have organized a $200,000 stock company to erect works at Montgomery, Ala.

Car Coupler.—In the case of the Loraine Car Coupler Co. vs. M. J. Loraine and the Keystone Car Coupler Co., an absolute decision for the plaintiff has been rendered. This will compel the Keystone Co. to make over to the Loraine Co. all coupler patents made by M. J. Loraine subsequent to the sale of the original ones of the plaintiffs.

Pipe Works.—The Richland, Va., Tube Works have been organized, with H. L. Grove, President; E. R. Dick, Vice-President; S. Lewis, Jr., Secretary. The plant will turn out about 125 tons a day.

Railway Buildings.—The Baltimore & Ohio R. R. will erect a new station at Rankin, Pa. The Cleveland, Cincinnati, Chicago & St. Louis Ry. will build new stations at Lafayette and Muncie, Ind., and Fern Bank, O. Nearly all the land for the new Union depot at Omaha, Neb., has been purchased. The Union Pacific Ry. will build a $25,000 station at Medicine Bow, Wis.

The Wharf at Oakland, Cal., will be rebuilt at a cost of $11,500.

A Masonic Temple, costing in the neighborhood of $500,000, will be built in Kansas City, Mo.

Iron Works.—The Columbia Iron & Steel Co. and the Pennsylvania Construction Co., at Uniontown, Pa., have been sold to English parties.

New Companies.—The American Concave Spring Co., of Jersey City, N. J.; capital stock, $30,000. Debardelaben Coal & Iron Co., Montgomery, Ala.; capital stock, $10,000,000. Portsmouth (O.) Paving Brick Co.; capital stock, $30,000. Electrical Safety Railway Switch Co., New Orleans, La.; incorporators, C. A. Fish, A. W. Berne, J. W. Adams and others; capital stock, $100,000. The Tacoma & Eastern R. R. Co., Tacoma, Wash.; incorporators, G. E. and J. F. Hart, L. W. Walker; capital stock, $250,000.

The Berlin Iron Bridge Co. will put up a new foundry for the Pratt & Cary Co., Hartford, Conn. This will be 250 × 75 ft., of brick and iron, and having a 10-ton traveling crane running the whole length of the building.

The Industrial Works, Bay City, Mich., are building a pile driver for the Mexican Central Ry., a 35-ton wrecking crane for the Denver & Rio Grande R. R., a construction crane for the South Carolina Ry., and a stationary crane for the Illinois Central R. R.

Metal Market Prices.—*Rails*—New York: $31 to $32; old rails, $24 to $24.50 for iron, $19 to $19.50 for steel. Chicago: $34 to $35.50; old rails, $23.50 for iron, $22 for steel. Pittsburg: $31 to $32; old rails, $26.20 to $26 for iron; $21 to $21.50 for steel.

Foundry Pig-iron.—Chicago: $14 to $17.50. Pittsburg, $14.50 to $17.50. New York: $16 to $18.50.

Track Materials.—New York: fish plates, 1.75 to 1.9 cts.; spikes, $2 to $2.05; track bolts, 2.8 to 3 cts. with square nuts. Pittsburg: splice bars, 1.95 to 2.05 cts. for iron; spikes 2.05 to 2.15 cts.; track bolts, 2.85 with square, and 3 cts. with hexagon nuts. Chicago: splice bars, 2.25 cts. for steel, and 2 to 2.05 cts. for iron; spikes, $2.10 to $2.15; track bolts, 3 to 3.15 with hexagon nuts.

Pipe.—Cast-iron, about $27 to $30 per ton, according to competition and amount of order. Wrought iron, discounts as follows: 47½ and 40 per cent. on black and galvanized butt-welded; 60 and 47½ on black and galvanized lap-welded. Casing, 50 per cent.

Lead.—Chicago, 4.4 to 4.45 cts.

Structural Material.—Pittsburg: angles, 2.15 to 2.2 cts.; tees, 2.75 cts.; beams and channels, 3.10 cts.; sheared steel bridge plates, 2.65 to 2.75 cts.; universal mill plates, 2.3 cts.; refined bars, 1.90 to 2 cts.; steel plates, 4.25 to 4.75 cts. for fire box; 3.15 to 3.20 cts. for flange; 3 cts. for shell, 2.75 cts. for tank. Chicago: angle, 2.3 cts.; tees, 2.75 to 2.8 cts.; beams, 3.2 cts.; universal plates, 2.45 to 2.55 cts. New York: plates, 2.15 to 2.20 cts.; angles, 2.2 to 2.25 cts.; tees, 2.5 to 2.6 cts.; beams and channels, 3.1 cts.

Commonwealth of Massachusetts.

Metropolitan Sewerage Commissioners.

NOTICE TO CONTRACTORS.

Sealed bids for building sections 8 and 9 of the Metropolitan Sewerage System (East Boston) and sections C and D (Brighton), all in the city of Boston, in accordance with the form of contract and specifications to be furnished by the Board of Metropolitan Sewerage Commissioners, will be received by said Board at its office, 93 Lincoln street, Boston, Mass., until 12 o'clock M. of Wednesday, Aug. 13, 1890.

No bid will be received unless accompanied by a certified check for the sum of one thousand dollars.

All bids must be made upon the blank forms furnished by the Board.

The external diameter of the sewer on sections 8 and 9 is from eleven to fifteen feet, and on sections C and D is from six and one half to nine feet. Some other particulars are approximately as follows:

Sec.	Length. Feet.	Av. depth. Feet.	Cub. yds. brick masonry.	Cub. yds. concrete masonry.	No. piles.
8.....	4,100	15	1,800	4,900	40
9.....	3,700	14	2,000	4,000	40
C.....	5,800	15	1,500	2,600	1,000
D.....	5,400	16.5	1,600	2 400	100

Plans can be seen and specifications and form of contract can be obtained at the above office.

Each bidder is required to make a statement indicating what sewer and similar work he has done, and to give references that will enable the Board to judge of his business standing.

The Board reserves the right to reject any and all bids.

HOSEA KINGMAN, TILLY HAYNES, ROBERT T. DAVIS. } Board of Metropolitan Sewerage Commissioners of Massachusetts.

HOWARD A. CARSON, Chief Engineer.

29 4t

Competition.

Architects are invited to submit designs for remodeling and repairing the present Hospital in the City of Louisville, Ky.

They are also invited to submit designs for building a new Hospital either as a whole or in sections, the design to be so arranged that it can be added to from time to time, and at the same time serve the city for Hospital uses.

The expenditure contemplated for remodeling must not exceed $70,000 and any design for a new Hospital being accepted the expenditure will not exceed the above amount at present time and the designs must be so arranged that it may be used as far as built for Hospital purposes until completed.

Plans must be submitted the **2d day of August,** 1890, addressed to the Mayor of the City of Louisville and must involve such drawings as will enable a clear idea of the cost and character of the construction to be performed.

Any plan must contemplate the use of the old material in the present Hospital as far as possible.

Any further information desired, together with a sketch of the ground, plan and height of the present building can be obtained by addressing

INSPECTOR OF BUILDINGS, CITY OF LOUISVILLE.

Notice to Sewer Contractors.

Sealed proposals will be received by the Sewerage Committee of the Board of Aldermen of the city of Greensboro, N. C., at the Mayor's office of said city, until 3 o'clock P. M. of Thursday, Aug. 21, 1890, for constructing a part of the proposed system of pipe sewers for said city.

Copies of the general plans and specifications, forms of proposals, and instructions to contractors, and any information relative thereto, may be obtained from the Chairman or Engineer of the Sewerage Committee. The committee reserves the right to reject any or all bids.

WM. M. HOUSTON,
Chairman Sewerage Committee.
J. L. LUDLOW, Engineer. 30-2t

Notice to Contractors.

Bids will be received until the FIRST OF AUGUST for the construction of a TEN MILLION GALLON RESERVOIR. Plans and specifications can be seen at the office of the Fort Madison Water Company, Fort Madison, Iowa.

GEORGE H. PIERSON,
30-1t Chief Engineer.

S. E. NOBLE, Prest. JNO. E. WARE, Secy. and Treas. R. F. CARTER, Supt.

The Anniston Pipe Works,

MANUFACTURERS OF

CAST IRON WATER AND GAS PIPE,

ANNISTON, - - - - ALA.

SEND FOR ILLUSTRATED CATALOGUE OF THE

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STEAM PUMP.

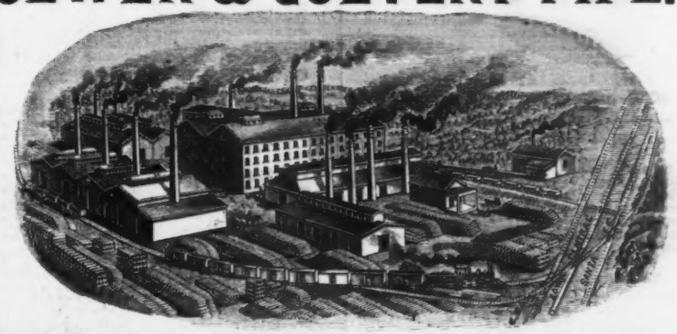
Especially adapted for Elevating all kinds of Liquids Quickly, Cheaply and Efficiently, no matter how Gritty, Thick, Hot or Cold, without Skilled Labor, Oil, or Machinery.

Economical. Simple. Durable. Compact. Efficient.

PULSOMETER STEAM PUMP CO., New York.

Cumberland M'f'g Co.
Warren Filter
220 Devonshire St. Boston.

DOUBLE STRENGTH
SEWER & CULVERT PIPE.



MONMOUTH MINING & MFG. CO., MONMOUTH, ILL.

Carrollton, Ill., Waterworks.

Sealed proposals will be received by the Mayor and City Council of the City of Carrollton, Ill., until 12 o'clock, M., July 25, 1890, for the construction of a system of water-works, according to plans and specifications for the same which may be seen at the office of the City Clerk, Carrollton, Ill., or at the office of the engineer, Geo. Cadogan Morgan, 15 Major Block, Chicago.

Bids may be for the entire system, or for any specific part thereof, and bids will be received for material and workmanship separately.

All proposals must be sealed and marked "Proposal for Water-Works," and must be filed with the City Clerk of said city on or before the time stated above.

Each proposal must be accompanied with a certified check, made payable to the City Treasurer of said city, as a guarantee of good faith, for the sum of $250; the same to be returned when proposal is rejected, or accepted and a satisfactory bond deposited with the Mayor and City Council.

The right is reserved by the city to make any additions to or deductions from the accepted proposal to the amount of fifteen (15) per cent. of the same at any time before the goods are ordered or work done on all or any part of the system, and the right is also reserved to reject any and all bids.

Signed: ED. MINER,
28-3t City Clerk.

To Sewer Contractors.

Sealed proposals are hereby invited by the City of Colorado Springs for furnishing all materials and labor, and bearing all expense and constructing in place lines Nos. 7, 8 and 9 of the sewer system of said city, as per profiles, plans and printed instructions on file in the office of the City Engineer of said city, on and after July 20th, A. D. 1890.

The following are approximate estimates of quantities:

4,000	feet of	12-inch	pipe	laid	6 to	9	feet	deep.
1,000	"	12	"	"	" 9	" 10	"	
4,800	"	10	"	"	" 6	" 9	"	
4,600	"	10	"	"	" 9	" 10	"	
3,985	"	8	"	"	" 6	" 9	"	
900	"	8	"	"	" 9	" 10	"	
3,800	"	6	"	"	" 6	" 9	"	

100 12x6 Y branches
300 10x6 "
250 8x6 "
300 6x6 "
} Counted in as straight pipe in above figures.

68 manholes.

The work to be done in four (4) months from date of contract.

Proposals will be made on blanks furnished by the city, each to be accompanied with a certified check for $2,000, as specified in such blanks, and must be in by 5 o'clock P. M., July 28th, 1890.

Pipe must be equal in quality to Akron standard pipe.

Separate bids will also be received on the above work, the city to furnish all pipe and cement materials.

The right is reserved to reject any or all bids.

W. R. ROBY,
Chairman Sewerage Committee.
H. I. REID,
City Engineer.

Colorado Springs, Colo.,
July 9th, 1890. 29-2t

Street Paving.

Sealed proposals will be received for furnishing the material and laying about 3,300 sq. yds. of granite block paving and 170 sq. ft. of crossing stone, at the office of the Board of Road Commissioners, City Hall, City of Waterbury, Conn., until 12 P. M., July 30, at which time and place they will be publicly opened and read. All bids must be upon proper blanks, and must be accompanied by a bond for $200 with satisfactory sureties conditioned for the execution of the contract within five days after notice of its award.

A certified check for $200 payable to the City of Waterbury to be deposited with the Board of Road Commissioners will be received in place of the above bond. Specifications can be seen at the City Engineer's office, at which place blank forms of proposal can be obtained as well as further information.

By order of Board of Road Commissioners,

F. W. WHITLOCK,
30-1t Acting City Engineer.

Proposals for Sewers.

MAYOR'S OFFICE, LA SALLE, ILL., July 18, 1890.

Sealed proposals will be received at the office of the City Clerk until 8 o'clock P. M., Aug. 5, 1890, for constructing about twenty-five thousand (25,000) feet of sewers, fifteen hundreds (1,500) feet of brick, the remainder 8 to 24-in. pipe, together with man holes, catch basins, and other appurtenances. The work is divided as follows:

Division A, 15,000 ft.
Division B, tunneling 740 ft.
Division C, 6,180 ft.
Division D, 4,500 ft.

Contractor to furnish all labor and material, except a small amount as specified that the city will furnish. Work to be done according to plans and specifications on file in this office, where they can be seen on and after July 20, 1890. Each division will require a separate bid, and each bid shall be accompanied by a deposit bond or certified check for five hundred ($500) dollars, and the contractor's bond shall equal the full amount of the contract. The right is reserved to reject any or all bids. Mr. W. P. Rounds is the Constructing Engineer.

F. W. MATTHIESSEN,
30-1t Mayor.

To Highway Contractors.

TO ALL WHOM IT MAY CONCERN.—*Whereas*, the Common Council of the City of Dunkirk, at a regular meeting thereof, held at the Council Room in said city on the 15th day of July, 1890, did resolve to macadamize the road in that portion of Lion St. lying between a point 10 ft. north of the south line of Third St., and running to a point 350 ft. south of the south curb line of Fourth St., by constructing a stone macadam roadway 30 ft. in width, with the necessary curbs, gutters and cross-walks between said points, excepting such portions thereof as are occupied by the Dunkirk & Fredonia St. R. R. Co.; also, to pave to a width of 5 ft. on either side of the macadam and next to the curb lines with bowlders; and

Whereas, Said Common Council did at the same time and place direct the City Clerk to advertise in the city paper and in some general contractors' paper for one week for bids for carrying on such improvement, such bids to be returnable to the City Clerk on or before Tuesday, Aug. 5, 1890, at 7:30 o'clock P. M.

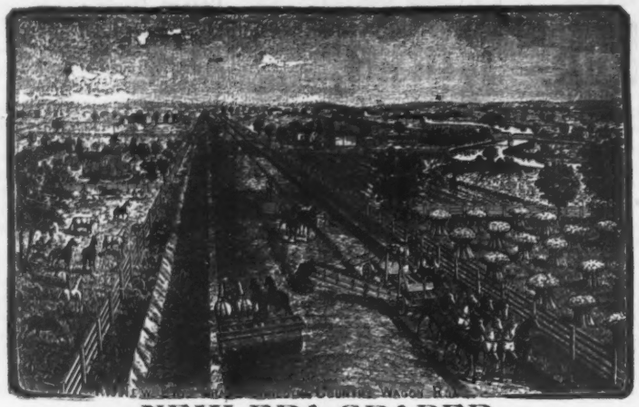
Now, therefore, TAKE NOTICE that any and all persons desiring or willing to furnish the necessary materials for the said improvement, and to do the said work, are hereby invited to make proposals therefor, and seal them and deliver them to the undersigned at his office in this city.

And further take notice, That any person desiring to bid on said work and materials, by application to the expert civil engineer, George D. Baker, Dunkirk, N. Y., will be furnished with complete specifications showing the work to be done, the materials to be furnished, and the form and manner in which such work must be done, and such materials must be used.

The bids must be delivered to the under signed on or before the 5th day of August, 1890 at 7:30 o'clock P. M., at which time such bids will be opened and read in public by the Mayor and Common Council assembled.

The Common Council reserves the right to reject any and all proposals.

EDWARD MADIGAN, City Clerk.
Dated DUNKIRK, N. Y., July 22, 1890. 30-1



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A. B. BOWERS, Engineer.

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17 Cortlandt St, New York; 175 Dearborn St., Room 70, Chicago; Room 7, No. 137 Mont. St., San Francisco; 344 D St., N. W., Room 3 and 4, Washington, D. C.

WANTED.

To know the present address of Mr. Francis F. Hopp, a civil engineer, and within a year a resident of Birmingham, Ala.

BUFF & BERGER,

28-8t Boston, Mass.

Two Dredges for Sale.

We have for sale one one and one-half (1½) yard Dipper Bucyrus Dredge, and one one and one-half (1½) yard Dipper Marion Dredge. Both are in good condition; can be seen for a few weeks near Jolley, Calhoun County, Iowa. One Dredge can be seen running for the next three weeks. Address

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Jolley, Calhoun County, Iowa.

JULY 19, 1890. 30 4t.

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A Heller & Brightly small mining transit with vertical circle, stadia hairs, weight about 9 lbs., not very much used. Price $125, to be pronounced first class by makers.

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One hundred and fifty thousand lineal feet piling.

Two hundred and fifty thousand cross-ties.

One thousand acres clearing.

This work is located in the western part of Louisiana, between Columbia on the Ouachita River and Alexandria. This line runs through a high, dry, healthy rolling piney country. No swamps; excellent spring water and clear running streams; free from all malarial or swamp influences; sandy, loamy soil, light clearing, etc.; first-class scraper work. Profiles and specification can be seen at our office, Room 54, Gay Building, corner Pine and Third St., St. Louis, or on work at Columbia, La.; or at office of Rootes, Taylo & Co., Memphis, Tenn.

Construction rates from any point on Missouri Pacific to the work.

29-2t HENRY, FORREST & CO.

Editor (to associate)—Why did you accept this spring poem?

Associate—Well, sir, the blamed poet (for who does not blame him?) walked in here with that poem in one hand and a revolver in the other, and said I must take the poem or something worse. I told him I didn't wish anything worse than the poem, and took that.—*West Shore.*

WANTS.

50 Cts. 50 Cts

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WANTED.—To add to office force in large shops in Chicago, one or two Draftsmen experienced in Corliss and general engine designing; also, one or two Draftsmen experienced in mill building constructions and general machinery. Address C. F., care Engineering News. 26—

WANTED.—A first-class topographical draughtsman, one especially skilled in relief work, either pen or tint. Must be quick and reliable. Address (enclosing specimen of work and stating salary expected) NIER, HARTFORD & MITCHELL, Chattanooga, Tenn. 29-

WANTED.—The subscriber will be disengaged about July 24th, with 40 good laborers and pavers that worked on the Bradford reservoir. No ten cent contractors need wait to write. Square dealing and no labor trouble is the motto. Any company in need of such a gang of men will please write to T. P. CONNERY, Bradford Mass. 29-2t

WANTED.—Situation by young engineer; 7 years in practice in municipal engineering and railways; good draughtsman. City and railway engineers in need of assistant please correspond. Address F. LABELLE, Ottawa, Ont. 28-3t

WANTED.—Bridge engineer wants position as contracting agent in Iowa, Nebraska, Minnesota, and the Dakotas, with some reliable bridge company; can make correct estimates and plans. Address "CONTRACTING ENGINEER," Engineering News. 28-3t

WANTED.—A Civil Engineer who has had experience in designing plans for sewers and general city improvements. Must be a first-class draftsman and be able to take charge of party. Permanent position. Address "P. L. S.," care Engineering News. 28 4t

WANTED.—An engineer, with seven years' experience as assistant on water-works, city and railroad work, a graduate of Lehigh, is open for an engagement in which there is some hope of permanence. An accurate, neat and rapid draughtsman; has served in the capacity of office engineer for a large corporation. Field and office instruments. Highest testimonials from present and past employers. Office work in the South preferred. Address "ARET," Engineering News. 30-2t

WANTED.—Index and Title for Volume VI. and the Number for December 27, 1879, of ENGINEERING NEWS; will pay $1 each for them. Address Engineering News.

WANTED.—Experienced superintendent to locate coffer dam and build heavy masonry in Mississippi River at this place. Address R. P. McCORMICK, Room 12, 904 Olive St., St. Louis, Mo. 29-2t

WANTED.—A good draughtsman, capable of taking charge of locomotive work in the office under the direction of chief draughtsman; must be correct and capable of making calculations, estimates, etc. Apply at once with references to PORTLAND COMPANY, Portland, Me. 29-3t

WANTED.—Two or more graduates having had professional experience, to fill vacancies in the corps of Assistant Professors in the College of Civil Engineering, of Cornell University. Good salary and prospects for suitable candidates. Address correspondence to Professor E. A. FUERTES, Director, Ithaca, N. Y. 29-6t

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WANTED.—A well educated young man (21), just graduated from college, wants a place with a civil engineer. He has no technical experience. Anxious more for work than for salary. Address "TANGENT," this office. 30-1t

WANTED.—A graduate in civil engineering, having acquired seven years' practical experience in bridge work, house work and structural iron work in general, in several of our large rolling mills, and thoroughly competent in getting out detail drawings for the shops, also knowledge of strains, desires to take charge of a draughting room. Address "EXPERIENCE," Engineering News. 30-1t

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WANTED.—Address of Heckon Silveshag draughtsman and C. E., formerly with C., B. & Q. R. R. F. C. ROSSITER, 91 Washington St., Chicago, Ill. 30-1t

WANTED.—A position by a young graduate civil engineer. Office and field experience. References. Address GRADUATE, care Engineering News. 30-1t

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WANTED.—Permanent location by civil engineer; a practical, economical constructor and computor, surveyor and draughtsman, able to handle men. City engineers position or large contracting firm. Best of references. Address "U. S. Asst. Engineer," care Engineering News. 30-2t

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WANTED.—Position by competent bridge engineer. Has had many years' experience in estimate work and detail shop work in bridges and iron buildings. Will take charge of engineers' office. Address A. N., care Engineering News. 30-3t

Proposals for Sewer Construction.

City of Poughkeepsie, N. Y., Department of Water-Works and Sewers, Commissioners' Office, July 24, 1890. Sealed proposals will be received at this office until noon of Tuesday, Aug. 5, 1890, for constructing about 1,500 ft. of vitrified pipe sewers in this city. Plans and profiles may be seen, and specifications, contract, and forms of proposal, together with all necessary information, obtained on application at this office. All proposals must be made upon forms obtained at this office. The right is reserved to reject any or all proposals.

By order of Commissioners.

CHAS. E. FOWLER,
Superintendent of Water-Works and Sewers.
30-2t.

PROPOSALS FOR CEMENT FOR THE District of Columbia.—Office of the Commissioners, Washington, D. C., July 15, 1890. Sealed proposals will be received at this office until 12 o'clock M., on Tuesday, July 29, 1890, for furnishing cement for the public works for the District of Columbia. Blank forms of proposals and specifications can be obtained at this office upon application therefor, together with all necessary information, and only bids upon these forms will be considered. The right is reserved to reject any and all bids or parts of bids. J. W. Douglass, L. G. Hine, H. M. Robert, Commissioners, D. C. 29-2t

PROPOSALS FOR THE CONSTRUCTION of Sewers.—Office of the Commissioners, Washington, D. C., July 14, 1890. Sealed proposals will be received at this office until 12 o'clock M., on Thursday, July 31, 1890, for constructing in the District of Columbia terra-cotta pipe sewers, brick sewers and receiving basins. Blank forms of proposals and specifications can be obtained at this office upon application therefor, together with all necessary information, and only bids upon these forms will be considered. The right is reserved to reject any and all bids or parts of bids. J. W. Douglass, L. G. Hine, H. M. Robert, Commissioners, D. C. 29-2

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